



Comparative Studies Of Digitalization And Manual Method In Supply Chain & Operations

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ABSTRACT :

Purpose

The primary and initial aim of the research paper is to highlight the automation and digitalization in the supply chain management of textile industry. The context compared traditional manual and digitalized method in supply chain & operation in the Logistic Company.

Research (Methodology/Design)

This study examined supply chain management in a qualitative manner. The research findings and results are presented based on structured interviews with the researchers. The evidence-based findings will be used to identify the fundamental issues and future direction.

The research's conclusion indicated was encountering several difficulties in using conventional processing methods to meet supply chain goals and objectives. The industry faces problems and challenges, and the traditional model that was put into place was not robust enough, according to the reviews that interviewees provided. The issues facing the industry are addressed by presenting the most recent models, techniques, and methods. The research paper argues that the implementation of modern and innovative technology should be ensured to speed up the SCM mechanism.

Value/worth

The study provided insightful analysis and reflections on the differences between supply chain management in the past and present. The research paper also emphasizes the digitization that took place in the sector. To improve the entire supply chain process, the research also suggested a contemporary supply chain model and technique that could be applied to the supply chain.

Introduction:

To manage, integrate, and plan the flow of information, materials, and resources to provide the most optimal services and products to stakeholders, supply chain management involves changing raw materials into a saleable product and offering it to the consumer.

The goal of supply chain management is to manage, integrate, and plan information, material, and resources to provide the best service and products to stakeholders in the process of transforming raw materials into a saleable product.

Managing supply chains involves managing, integrating, and planning information, materials, and resources so that stakeholders receive the most optimal service and product possible in order to convert raw materials into saleable products and offer them to end users in the most efficient manner possible.

The purpose of supply chain management is to manage, integrate, and plan information flow, materials, and resources to provide stakeholders with the best service and products possible. In this process, raw goods are turned into a saleable product that can be offered to the end users.

Supply chain activities span procurement, product lifecycle management, supply chain planning (including inventory planning and the maintenance of enterprise assets and production lines), logistics (including transportation and fleet management), and order management. SCM can also extend to the activities around global trade, such as the management of global suppliers and multinational production processes.

SCM has historically been about increasing efficiency and reducing costs. Although those needs haven't changed, what has changed is that the customer is now playing a front-and-centre role in setting SCM priorities. It's been said that "customer experiences live and die in the supply chain."

Customer loyalty is predicated on an enterprise being able to fulfil customer expectations quickly and accurately. Raw materials, manufacturing, logistics, and trade and order management must all be coordinated to get a given item to the customer within a reasonable timeframe. To accomplish this, companies must look at their supply chains through their customers' eyes. It's not simply about getting the order to the customer on time; it's about doing everything at the right time—before, during, and after order delivery.

SCM is the broad range of activities required to plan, control, and execute a product's flow from materials to production to distribution in the most economical way possible. SCM encompasses the integrated planning and execution of processes required to optimize the flow of materials, information

and capital in functions that broadly include demand planning, sourcing, production, inventory management and logistics—or storage and transportation i.e. logistics.

Background

Even though the company's supply chain tasks are related to its vision, supply chain management has a significant benefit in that it expedites business operations. This gives the procedure for delivering goods and services that meet consumer expectations more clarity. Supply chain managers understand that a company's operations encompass more than just the transportation of raw materials. Supply chain innovations can help businesses provide the best service possible through cooperative systems.

To facilitate the cooperation of manufacturers, distributors, retailers, and consumers throughout the production, purchasing, and sales cycles, supply chain management integrates procurement, suppliers, and facilities. This supply chain requires proactive management because it is influenced by various business-controllable factors, such as fuel prices and environmental conditions. Even though a company is more conscious of these factors, it can handle them well. Production, inventory, distribution, vendor, and sale records are strictly regulated with effective supply chain management. The SCM provides customers with quick product offers and displays the management of expenses at every stage.

The impact of digital transformation issues suggests that there are changes occurring in the business environment, with ripple effects being felt across all industries. Their effects are highly contextual and change depending on the occasion. But one thing is for sure: businesses must adopt digital technology if they want to compete in the global market and outperform competitors.

The SCM can support the creation of the system for future advancement, such as international expansion, and help with the enterprise's strategic planning. Establishing strategic relationships between retail stores and farmers can foster business growth as the former is better equipped to leverage the latter's partnerships for commercial success. The supply chain management (SCM) helps the company align its product offerings with the needs and demands of the market.

Problem of the study

People now live in a technologically and digitally advanced world. As a result, the paradigm for the corporate work environment has completely changed. Businesses that aim to adopt modern business practices continuously incorporate digitalization and cutting-edge technology into their logistical processes, while those that don't put in the effort fade away from the market. Rapid changes in business operations have made supply chains more vulnerable, but technological integration has given them access to a variety of ways to be improved, making them more robust and effective.

Wider organizational changes serve as the foundation for digitalization. Businesses that continue to use several antiquated and labour-intensive procedures often fail because of adopting the new operational model. While a traditional organization adopts more digital procedures and advances using an innovative approach, gaps must be filled. According to a study, every company has a unique perspective on digitalization.

Furthermore, digitalized supply chains often enhance data collection and access by providing workers and customers with more useful information. Consumers desire control, convenience, and choice. Supply chains that are increasingly digitalized and data-driven produce services with the greatest possible benefits. The necessary structure must be constructed. The supply chain has several crucial points that needed to be attended to enable further actions. The information presenting items moving to different locations can be kept up to date, accurate, and easily accessible with the help of an automated, centralized, and digital solution. Utilizing digitalization can increase visibility. The current study identifies gap factors and illustrates models of both traditional and digital supply chains.

Purpose of Study

The goal of the current study is to evaluate the gaps between the traditional and digital supply chains. It's important to understand how implementing innovations can benefit both customers and businesses. To conduct a thorough analysis of the supply chain in the industry specifically, the research should model both traditional and digitalized supply chains. To achieve supply chain goals, there is a focus on digital improvement since it tends to improve outbound and inbound logistics. The goals of the supply chain are linked to both traditional and digital supply chain modes to determine which procedure is better suited to meet the needs of the business or of its clients.

1.4 Significance of the Study

It is important to compare digitalization and manual methods in supply chain operations for a number of reasons.

Cost Reduction: By doing away with manual labour, cutting down on paperwork, and maximizing resource use, digitalization frequently results in lower costs. Businesses can make well-informed decisions regarding technology investments by having a clear understanding of the costs associated with digitalization in comparison to manual methods.

Risk Mitigation: By offering real-time visibility, data analytics, and predictive capabilities, digitalization can improve risk management in supply chains. This enables companies to anticipate and reduce risks like delays, disruptions, and quality problems.

Customer satisfaction: Digitalization makes it possible to respond to requests more quickly, fulfil orders accurately, and communicate with clients more effectively. Businesses can find ways to improve customer satisfaction and experience by comparing digital and manual processes.

Scalability and Flexibility: Businesses can respond swiftly to shifting market conditions, shifts in demand, and supply chain disruptions thanks to the scalability and flexibility of digitalized supply chain operations, which are frequently more so than manual ones.

Innovation and Competitive Advantage: Businesses can stay up to date on industry trends, best practices, and emerging technologies by conducting a comparative analysis between digitalization and manual methods. This encourages creativity and gives companies a competitive edge in the market.

Research Questions

- What is the difference between traditional and digitalized supply chain models?
- How digitalized improvement in inbound and outbound logistics can help industries to achieve supply chain objectives?

Research Methodology

This study aims to evaluate the efficiency, and consequences of digitalization in comparison to manual methods in supply chain operations across multiple industries. The study intends to identify variables that affect the decision-making process regarding digitalization strategies and to offer insights into the advantages and difficulties of implementing digital technologies in the supply chain.

The methods /analysis used are:

- **Qualitative Analysis:** To find recurring themes, trends, and insights about the perceived benefits and drawbacks of digitization in comparison to manual processes, qualitative data (survey responses) are gathered. Questionnaire (qualitative) data is analysed using the primary qualitative analysis method, theme-based analysis.
- **Hypothesis Test:** To compare the variations between manual and digitalized methods, inferential statistical tests are done. Typical exams consist of:
 1. T-tests: used to compare the means (e.g., efficiency, accuracy, cost) of two independent samples.
 2. To compare means across multiple groups (e.g., efficiency across different levels of digitalization), used Analysis of Variance (ANOVA).
 3. Chi-square test: to look at the relationship between categorical variables (like customer satisfaction levels between manual and digitalized processes).

2. Literature Review

2.1 Introduction

A review of the literature regarding the digitization of supply chain operations, will be provided in this chapter. The industry, its function in supply chain management, its traditional and modern organizational structures, and the digitization of supply chain operations, inbound and outbound supply chain models—all of which are relevant to our research questions—will be covered in the first section of this chapter. Supply chain and management define the logistics process for in-bond and out-bond transactions. The process of supply chain management is covered in this literature. The key ideas are then discussed, and the prior research on the digitization of supply chain management and its elements is reviewed. A review of the supply chain model and supply chain management procedures will round out this chapter.

2.1 Digitalization in Supply chain operations in Industry:

The term "digitalization" in supply chain operations describes the incorporation of digital technologies and procedures to improve decision-making, efficiency, visibility, and collaboration across the supply chain. It entails making use of digital tools and platforms to optimize processes from distribution to procurement, automate processes, and collect and analyse data. The following are some crucial elements of supply chain operations' digitalization:

1. **Real-time Visibility:** With the use of technologies like RFID, Internet of Things sensors, and GPS tracking, digitalization makes it possible to track and monitor inventory, shipments, and production processes in real-time. Organizations can anticipate disruptions, find bottlenecks, and allocate resources more efficiently with the aid of this visibility. (Ivanov, D., & Dolgui, A. (2020). A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0. *Production Planning & Control*, 31(10-12), 969-983).
2. The idea of a "digital supply chain twin," which uses simulations and real-time data to improve supply chain operations' resilience and visibility, is covered in this paper.
3. **Data-oriented Digitalization** facilitates the process of making informed decisions by gathering and evaluating data from multiple sources, such as sensors, ERP systems, and external partners. This allows organizations to act on insights gained through the data. Algorithms for machine learning and predictive analytics can be used to forecast demand, optimize inventory levels, and reduce supply chain risks. (Chopra, S., & Meindl, P. (2019). *Supply chain management: Strategy, planning, and operation*. Pearson)

The idea of a "digital supply chain twin," which uses simulations and real-time data to improve supply chain operations' resilience and visibility, is covered in this paper.

1. **Data-driven Decision-making:** Digitalization enables organizations to make well-informed decisions based on actionable insights by gathering and analysing data from multiple sources, such as sensors, ERP systems, and external partners. Algorithms for machine learning and predictive analytics can be used to forecast demand, optimize inventory levels, and reduce supply chain risks. (Chopra, S., & Meindl, P. (2019). *Supply chain management: Strategy, planning, and operation*. Pearson).
2. **Platforms for Collaboration:** The sharing of information and collaboration between suppliers, manufacturers, distributors, and logistics providers is made easier by digital platforms and cloud-based solutions. Through the use of these platforms, supply chain network coordination and efficiency are increased through real-time communication, document sharing, and workflow automation. (Christopher, M., & Towill, D.

- R. (2001). An integrated model for the design of agile supply chains. *International Journal of Physical Distribution & Logistics Management*, 31(4), 235-246.)
3. **Blockchain Technology:** Using blockchain technology, supply chain transactions can be transparently and securely recorded and verified. Blockchain reduces fraud, counterfeiting, and disputes among supply chain participants by establishing a decentralized ledger of transactions that improves traceability, authenticity, and trust. (Iansiti, M., & Lakhani, K. R. (2017). *The truth about blockchain*. Harvard Business Review, 95(1), 118-127.)
 4. **Sustainability and Traceability:** Digitalization makes it possible for supply chains to be transparent and traceable, giving businesses the ability to monitor the source, path, and environmental impact of materials and goods. This transparency aids businesses in meeting sustainability objectives, adhering to laws, and satisfying customer demand for morally and environmentally sound products. (Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), 1699-1710.)

In order to demonstrate the importance of digitalization in promoting efficiency, innovation, and sustainability in today's supply chains, these offer empirical data and theoretical frameworks to support the role of digitalization in various aspects of supply chain operations.

2.3 MANUAL METHOD OF SUPPLY CHAIN OPERATION

The term "manual methods" in supply chain operations refers to conventional, analog methods of handling different supply chain components. These techniques frequently entail manual procedures, paper-based documentation, and human intervention. The following are a few typical instances of manual supply chain operations methods:

1. **Manual order processing:** Sales orders, purchase orders, and other transactional documents are created, processed, and managed manually utilizing spreadsheets or paper forms in manual order processing. The manual data entry and communication between various departments or stakeholders involved in order fulfilment are the foundations of this method (Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2008). *Designing and managing the supply chain: Concepts, strategies, and case studies*. McGraw-Hill.)
2. **Manual Record-keeping and Documentation:** Manual record-keeping and documentation entail the production, archiving, and retrieval of paper-based records, including shipping documents, invoices, and compliance records. This approach can be labour-intensive and prone to errors because it calls for physical storage space, manual filing systems, and manual retrieval procedures. (Monczka, R. M., Handfield, R. B., Giunipero, L. C., & Patterson, J. L. (2015). *Purchasing and supply chain management*. Cengage Learning.)
3. **Manual Inventory Management:** Using manual techniques like periodic stock counts or visual inspection, manual inventory management entails physically counting and monitoring inventory levels. Since inventory data is frequently entered by hand onto paper or into spreadsheets, there is a chance that it will contain mistakes, inconsistencies, and delays in updating inventory records. (Jacobs, F. R., & Chase, R. B. (2018). *Operations and supply chain management*. McGraw-Hill Education.)
4. **Manual Forecasting and Planning:** To estimate future demand, plan production schedules, and optimize inventory levels, manual forecasting and planning rely on spreadsheet models, manual data analysis, and subjective judgment. This approach might not be as precise, flexible, and scalable as automated forecasting and planning systems. (Mentzer, J. T., Stank, T. P., & Esper, T. L. (2008). *Supply chain management and its relationship to logistics, marketing, production, and operations management*. *Journal of Business Logistics*, 29(1), 31-46.)

In today's fast-paced and complex business environment, manual methods—while historically employed in supply chain operations—are frequently linked to inefficiencies, errors, and limitations. Because of this, a growing number of businesses are implementing automation and digital technologies to optimize workflows, boost precision, and increase supply chain visibility.

2.4 Key Concepts

Two different approaches to managing the flow of goods and services from the point of origin to the point of consumption are supply chain operations manual methods and digitalization. The two are contrasted as follows:

1. **Efficiency:**
Digitalization: Because of automation, real-time tracking, and data analytics capabilities, digital supply chain operations are typically more efficient. It is possible to streamline processes like order processing, inventory management, and logistics coordination, which will increase efficiency and decrease human error.
2. **Accuracy:**
Digitalization: Through real-time data monitoring and analytics, digital supply chain systems can offer high levels of accuracy. This makes it possible to make better decisions and lowers the possibility of mistakes in demand forecasting, order fulfilment, and inventory management.
3. **Visibility:**
Digital supply chain platforms provide improved visibility throughout the whole network of the supply chain. Proactive decision-making and risk management are made easier by this visibility, which enables stakeholders to track shipments, keep an eye on inventory levels, and spot possible bottlenecks or disruptions in real time.
4. **Scalability:**
Digitalization: Solutions for digital supply chains are typically more scalable because they can more easily adjust to changing business requirements and handle expansion. Scalability is especially provided by cloud-based platforms, which let businesses modify features and resources as needed.
5. **Cost:**
Digitalization: Although there might be up-front expenditures for software licensing and integration when putting digital supply chain

technologies into practice, these are frequently offset by long-term savings. Through increased productivity, decreased mistakes, better inventory control, and optimized resource use, digitalization can result in cost savings.

In conclusion, digitalization presents several benefits over manual methods that have historically been employed in supply chain operations, including increased efficiency, accuracy, visibility, scalability, and cost-effectiveness. Achieving operational excellence and satisfying customer expectations has become more and more dependent on businesses adopting digital supply chain technologies as they fight to remain competitive in today's quickly changing market landscape.

2.5 CHALLENGES AND BARRIERS TO DIGITALIZATION ADOPTION IN SUPPLY CHAIN OPERATIONS.

Adopting digitalization in supply chain operations can undoubtedly encounter several difficulties and impediments, from organizational to technological limitations. These are a few of the main obstacles:

- **Problems with Integration:** It can be difficult to integrate different digital tools and systems at different supply chain stages. When connecting disparate systems, compatibility, interoperability, and data synchronization problems can occur, causing operational disruptions and inefficiencies.
- **Costs and ROI Uncertainty:** Putting digital supply chain solutions into practice frequently necessitates large upfront investments in infrastructure, organizational change management, technology, and training.
- **Lack of Knowledge and Experience:** Using digital technologies calls for knowledgeable individuals who are capable of designing, implementing, and overseeing intricate systems. Organizations may find it challenging to successfully implement digitalization initiatives due to a lack of talent in fields like supply chain optimization, artificial intelligence, data analytics, and the Internet of Things (IoT).
- **Concerns about Regulation and Compliance:** Digitalization initiatives may face difficulties adhering to industry standards and regulations, such as supply chain transparency requirements and data privacy laws (CCPA, GDPR, etc.). Although crucial, ensuring that digital systems follow all applicable laws, guidelines, and standards while preserving data security and integrity can be difficult and resource intensive.

It will take a team effort from industry stakeholders, employees, technology providers, and organizational leaders to overcome these obstacles. Clear communication, strong change management techniques, talent development investments, partner collaboration, and a focus on removing both technical and cultural adoption barriers are frequently seen in successful digitalization projects.

2.6 STRATEGIES FOR OVERCOMING THE CHALLENGES AND FACILITATING THE TRANSITION TO DIGITALIZED SUPPLY CHAIN MANAGEMENT.

- **Leadership and Change Management:** Promoting a culture of innovation and continuous improvement as well as advancing digitalization initiatives require strong leadership support. Effective change management techniques should be used by leaders to address concerns and resistance to change, involve staff members at all levels, and convey the vision for the digital transformation.
- **Investing in Training and Upskilling:** It's critical to give staff members the chance to grow professionally and gain the knowledge and proficiency in digital technologies. Soft skills like flexibility, problem-solving, and teamwork are included in addition to technical skills like automation, data analytics, and software use.
- **Pilot Projects and Proof of Concepts:** To test new technologies, procedures, and systems, organizations can undertake pilot projects and proof of concepts prior to scaling digitalization initiatives throughout the entire supply chain.
- **Partnerships and Collaboration:** Working together with industry partners, research centers, technology providers, and other stakeholders can help solve issues with supplier readiness, knowledge gaps, and technology integration. Creating strategic alliances can also make it easier to share knowledge, get resources, and collaborate on innovative projects.
- **Modernizing Legacy Systems:** Supply chain operations can become more agile and efficient by gradually updating legacy systems or moving to more adaptable, scalable, and interoperable digital platforms. This can also reduce integration difficulties. Adoption of interoperability standards, data migration plans, and phased upgrades could all be part of this.
- **Data Security and Privacy Measures:** Protecting sensitive data and reducing cyber threats require the implementation of strong data security and privacy measures, such as encryption, access controls, identity management, and frequent security audits.
- **Cost-Benefit Evaluation and Return on Investment:** Performing comprehensive ROI evaluations and cost-benefit analyses can support the case for funding digitalization projects and show stakeholders what the value proposition is. Establishing quantifiable objectives for development and identifying key performance indicators (KPIs) helps organizations monitor advancement and assess the efficacy of digital solutions.
- **Iterative and Agile Methodology:** Organizations can quickly adjust to changing requirements, iterate on solutions based on feedback, and continuously improve systems and processes by implementing an agile and iterative approach to digital transformation. This lowers risks, expedites time to market, and improves responsiveness to customer demands and market dynamics.
- **Continuous Measurement, Monitoring, and Improvement:** Long-term success in the digital supply chain depends on the establishment of systems for ongoing measurement, monitoring, and improvement.

2.7 FUTURE DIRECTIONS AND IMPLICATIONS:

GAPS IN RESEARCH AND OPPORTUNITIES FOR FUTURE STUDIES.

Even though the study of digitalized supply chain operations has advanced significantly, there are still several unanswered questions and areas that could be explored in more detail.

- **Impact of Emerging Technologies:**

The digitalization of supply chain operations has been greatly impacted by emerging technologies, which have changed conventional procedures and improved agility, efficiency, and visibility. Tasks in distribution centers and warehouses are streamlined by automation and robotics, which increases throughput and lowers errors (Ivanov & Dolgui, 2020). Devices connected to the Internet of Things (IoT) enable real-time tracking and monitoring of commodities, improving inventory control and guaranteeing supply chain transparency (Trivedi, 2020). Blockchain technology lowers fraud and permits safe transactions by guaranteeing data integrity and improving traceability throughout the supply chain (Ivanov & Das, 2021). Dynamic decision-making is made possible by artificial intelligence (AI) and machine learning (ML) algorithms that evaluate enormous datasets to forecast demand, optimize routing, and reduce risks (Ivanov & Dolgui, 2020). These technologies include 3D printing, virtual reality (VR), augmented reality (AR), and big data analytics.

- **Resilience and Risk Management:**

When it comes to digitalizing supply chain operations, resilience and risk management are essential, especially when dealing with disruptions like pandemics, natural disasters, or geopolitical events. Supply chains can become more resilient through digitalization because it improves visibility, flexibility, and responsiveness to unforeseen challenges. Digital twins, for example, can be used to simulate different scenarios, which enables organizations to proactively identify vulnerabilities and create backup plans (Ivanov & Dolgui, 2020). Furthermore, supply chain transparency and traceability are improved by technologies like blockchain, reducing the risk of fraudulent activity or counterfeit goods (Ivanov & Das, 2021). Furthermore, firms can minimize the impact of risks by optimizing inventory levels, detecting possible disruptions early, and dynamically adjusting production and distribution processes thanks to real-time data analytics and AI-driven predictive algorithms (Christopher & Peck, 2004).

- **Sustainability and Environmental Impact:**

The promotion of sustainability and the mitigation of environmental impact are significantly enhanced by the digitalization of supply chain operations. Organizations can optimize resource utilization, minimize waste, and reduce carbon footprint throughout the supply chain network by utilizing technologies like blockchain, artificial intelligence, and the Internet of Things (IoT). IoT sensors, for instance, make it possible to monitor energy use, emissions, and waste production in real-time, which enables businesses to spot inefficiencies and make specific improvements (Sarkis et al., 2019). By offering unchangeable records of origin and production processes, blockchain technology improves transparency and traceability and makes it possible to source products ethically and sustainably (Ivanov & Das, 2021). Predictive analytics powered by AI also optimizes inventory control and transportation routes, lowering fuel use and greenhouse gas emissions (Ivanov & Dolgui, 2020). All things considered; a more sustainable supply chain is promoted by the digitization of operations.

- **Cross-Country Collaboration and Ecosystem Dynamics:**

As businesses realize the benefits of forming alliances and partnerships to spur innovation and accomplish common goals, cross-industry cooperation and ecosystem dynamics are becoming more and more crucial to the digitalization of supply chain operations. To create seamless end-to-end processes, digital supply chain ecosystems require collaboration among various stakeholders, such as manufacturers, suppliers, logistics providers, and technology vendors (Ivanov & Das, 2021). For instance, collaborations between logistics firms and retailers provide faster and more affordable delivery choices by utilizing shared infrastructure and data analytics skills (Ivanov & Dolgui, 2020). Furthermore, supply chain visibility and trust are improved by platforms like blockchain, which enable safe data sharing and collaboration amongst various organizations (Sarkis et al., 2019). Companies can discover new avenues for efficiency and innovation by embracing ecosystem dynamics and encouraging cross-industry collaboration.

- **Regulatory and Policy Consideration:**

The digitalization of supply chain operations is significantly influenced by regulatory and policy factors. Governments and regulatory bodies are tasked with ensuring compliance, data security, and ethical practices in a business environment that is becoming more interconnected and data driven. For instance, stringent rules governing the gathering, storing, and processing of personal data, such as the California Consumer Privacy Act (CCPA) in the US and the General Data Protection Regulation (GDPR) in the EU, have an impact on how businesses handle client information in digital supply chains (Ivanov & Das, 2021). Regulations pertaining to product safety, trade compliance, and environmental protection also have an impact on supply chain operations, so businesses must incorporate these requirements into their digitalization strategies (Ivanov & Dolgui, 2020).

The operations of digitalized supply chains can be improved by addressing these gaps and opportunities through interdisciplinary research collaborations, case studies, empirical investigations, theoretical frameworks, and longitudinal studies. These efforts can also help organizations navigating the complexities of the digital age make more informed strategic decisions.

Conceptual Framework

This chapter discusses the theoretical viewpoint that shows how the process of digitalization has caused a paradigm shift in the supply chain and how this change has affected both inbound and outbound logistics operations.

Companies of all sizes are currently considering how they should make digital transformations and changes in the supply chain operations due to the need for a "perpetually connected" business environment and customers. Businesses are expected to provide the best goods and services in the quickest amount of time.

Digitalization of the international or overall supply chain gives more power to companies in terms of planning, sourcing, and logistics groups to automate, collaborate, and leverage analytics in an effective manner. Digital supply chain allows collaboration in several external and internal people or systems. This is one of the features that make a control tower. Collaboration makes chances to lessen and eradicate the disintegration in terms of information sharing wherein information is help in separate packed boxes or spreadsheets.

This makes the SCM more agile and responsive. Both aspects are a major part of the digital supply chain. Automation is an end-to-end platform digitally. It makes efficient, eradicates manual repeated errors, enhances the accuracy of the information, and improves the speed of the supply chain by automating several manual and labour-intensive processes. Moreover, digital processes help decision-making at several processes of the lifecycle. For instance, initial costs are automated, and alerts can be generated automatically while purchase orders are at risk of complications or postponements.

Likely, the tasks of locating and qualifying goods eligible for free trade initiatives are identified. Automation further decides the most suitable mode of shipping, carriers, and planning when taken into view speed, time, and purity in terms of other elements.

It is also applicable to computer processes. This increases value and helps the operating channel become more flexible and adaptive. Due to a decrease in manual labour, the digitalized supply chain requires fewer workers and human resources once it is established. As a result, the supply chain requires less time and money to operate overall. The other advantage is that shippers can reduce inventory and safety stock levels thanks to a more reliable and consistent supply chain, especially in highly competitive industries.

Logistic companies must adopt a comprehensive and integrated strategy to operate efficiently. This comprehensive strategy for creating a digital supply chain includes product development, sourcing optimization, global supply management, factory or product risk assurance, quality assurance, and management of international transportation, import, duty, and logistics processes.

SUMMARY

In conclusion, the digitalization of supply chain operations offers a multitude of advantages over manual methods. By embracing digital technologies, businesses can significantly enhance their efficiency, visibility, and transparency throughout the supply chain. Automation reduces errors and delays, while real-time data insights enable better decision-making and proactive problem-solving. Moreover, digitalization fosters agility and flexibility, empowering organizations to adapt quickly to changing market conditions and customer demands. Collaboration is also strengthened by digital tools, providing smooth communication and coordination among parties. Ultimately, the shift towards digital supply chain operations represents a crucial step towards achieving greater competitiveness, resilience, and sustainability in today's dynamic business landscape.

4. Research Methodology

This study aims to evaluate the efficiency, and consequences of digitalization in comparison to manual methods in supply chain operations across multiple industries. The study intends to identify variables that affect the decision-making process regarding digitalization strategies and to offer insights into the advantages and difficulties of implementing digital technologies in the supply chain.

In this research methodology is used. Employees provide the necessary data for the study by filling out a questionnaire. Data presented in tables and charts, along with statistical tools, have been used for analysis and interpretation in OM Logistics. Random sampling has been adopted and the size of the sample of this study is 89 customers. This sample covers males only. The aim of the study is to find employee and customer experience in digitalization in supply chain operation. our customers are the organizations which require logistics services in their business to earn profit. The research proves a sufficient level of reliability or validity is present for the new digitalized methods.

3.2 RESEARCH PHILOSOPHY

The key to creating an efficient research process that allows for the in-depth reality of knowledge to be searched and provides a means of interpreting the information on the research topic is to base the research on strong beliefs. The approach, methodology, and interpretation of results in a study comparing digitalization versus manual methods in supply chain operations can be greatly impacted by the research philosophy used.

- A positivist approach is used for systematic observation, measurement, and analysis of empirical data to find objective truths. By using this philosophy, quantitative studies are conducted to compare the effectiveness of manual and digital methods based on quantifiable criteria like accuracy, cost, and efficiency.
- Through meticulous evaluation of the fundamental presuppositions and consequences of distinct research methodologies, formulated the comprehensive comparative analyses that yield significant contributions to the theory and practice of supply chain management and digital transformation.

3.3 RESEARCH DESIGN

A key component of any research study is the research design, which offers a thorough framework for combining various aspects of the research process. A suitable research design has been chosen for the study in accordance with the chosen approach and philosophy.

A mixed-methods research design would be used in comparing the digitalization and manual methods in supply chain operations. To thoroughly evaluate the effectiveness, benefits, and drawbacks of both digital and manual methods across a range of dimensions, including efficiency, cost, visibility, flexibility, collaboration, risk management, and customer satisfaction, this approach combines quantitative data analysis with qualitative inquiry. While qualitative techniques like focus groups, interviews, or case studies which offers deeper insights into the contextual factors, organizational dynamics, and human perceptions that influence the adoption and outcomes of digitalization initiatives versus manual approaches in supply chain management, quantitative techniques is used to collect quantitative data through questionnaire to quantify key performance indicators and metrics.

Informing evidence-based strategies for digital transformation and optimization, this mixed-methods research design provided a comprehensive understanding of the intricate interactions between people, processes, technology, and organizational contexts that shape supply chain operations.

3.4 RESEARCH METHOD

One of the most important research methodological decisions is choosing an appropriate research methodology in a comparative study of digitalization and manual methods in supply chain operations i.e mixed-methods research approach is employed. This approach combines quantitative analysis with

qualitative inquiry to provide a comprehensive understanding of the subject matter. Quantitative methods such as questionnaire statistical analysis is utilized to quantify key performance indicators and metrics, while qualitative methods such as case studies offers insights into the contextual factors and human perceptions that influence the adoption and outcomes of digitalization versus manual approaches in supply chain management. This mixed-methods approach ensures a robust and multifaceted examination of the topic, leading to more nuanced findings and actionable recommendations. (Huang, G. Q., Zheng, L., & Qu, T. (2019). Digital Twin-Driven Smart Manufacturing. Springer.)

3.5 DATA COLLECTION METHOD

A combination of quantitative and qualitative data collection techniques is used for capturing both objective performance metrics and subjective experiences and perceptions in a comparative study of supply chain operations using digitalization versus manual methods.

The data collected for the study consists of both primary and secondary data.

PRIMARY DATA

To gather primary data for any research study, techniques like questionnaires, interviews, and observation methods are regularly employed. The most adaptable technique among them all, the questionnaire technique was employed to collect data since it could combine opinions and interventions. The main source of data is the employees and cliental.

SECONDARY DATA

For this study, secondary data were gathered from. through getting data from the clients. through looking at and analysing earlier research projects. books, periodicals, webpages, and online resources.

3.6 DATA ANALYSIS TECHNIQUES

For the comparative study of digitalization and manual methods in supply chain operations, following analysis techniques are used:

- Qualitative Analysis: To find recurring themes, trends, and insights about the perceived benefits and drawbacks of digitization in comparison to manual processes, qualitative data (survey responses) are gathered. Questionnaire (qualitative) data is analysed using the primary qualitative analysis method, theme-based analysis.
- To compare the variations between manual and digitalized methods, inferential statistical tests is done. Typical exams consist of:
 - i) T-tests: used to compare the means (e.g., efficiency, accuracy, cost) of two independent samples.
 - ii) To compare means across multiple groups (e.g., efficiency across different levels of digitalization), used Analysis of Variance (ANOVA).
 - iii) Chi-square test: to look at the relationship between categorical variables (like customer satisfaction levels between manual and digitalized processes).
- Data Visualization: To present the results in an intelligible and clear way, use data visualization techniques like graphs, charts, and dashboards. Trends, anomalies, and connections in the data were easier to find and understand with the aid of visual representations.

3.7 ETHICAL CONSIDERATION

Primary data is collected in this research study, and thus, ethical considerations related to this data collection method are followed including questionnaire. An information sheet is sent to the analyst of different companies and secondary data are being considered more for accuracy in research. Questionnaire responses are saved in a password-protected system to limit access of data by the third party.

3.8 SUMMARY

The study's results are compiled, and conclusions are made about the relative benefits of digitization over manual processes in supply chain management. Based on the research findings, practitioners are given recommendations. By using this research methodology, the study hopes to shed light on the advantages and efficacy of digitalization over manual methods in enhancing supply chain performance.

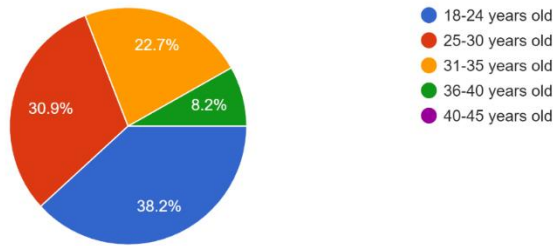
DATA ANALYSIS AND DISCUSSION

QUALITATIVE ANALYSIS

To find recurring themes, trends, and insights about the perceived benefits and drawbacks of digitization in comparison to manual processes, qualitative data (survey responses) are gathered. Questionnaire (qualitative) data is analysed using the primary qualitative analysis method, theme-based analysis.

Age

110 responses

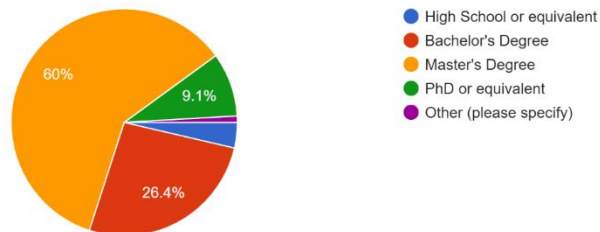


Interpretation

In our survey the age group of people are 38% people are in between 18 – 24, 30.9% people are in between 25 – 30, 22.7% people are in between 31 – 35, 8.2% people are in between 36 – 40

Educational Background

110 responses

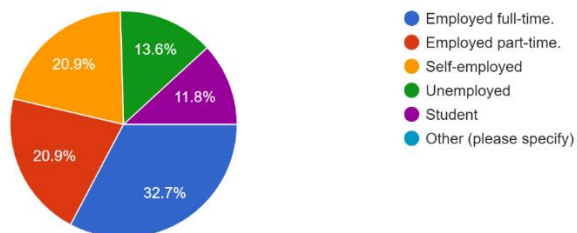


Interpretation

In the above graph we can see that 60% people are doing Master's Degree, 26.4% people doing Bachelor's Degree, 9.1% of people are doing PhD or equivalent and 4.5% are others.

Employment Status:

110 responses

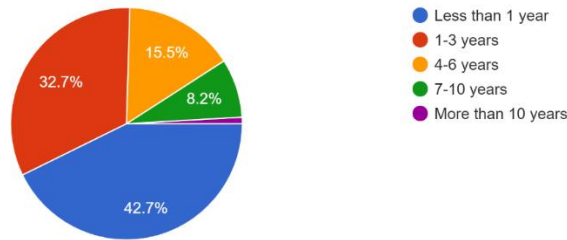


Interpretation

According to this survey 32.7% of people are employed full-time, 20.9% people are both employed part-time and self-employed, 13.6% people are unemployed and 11.8% are student.

How many years of experience do you have in supply chain operations?

110 responses

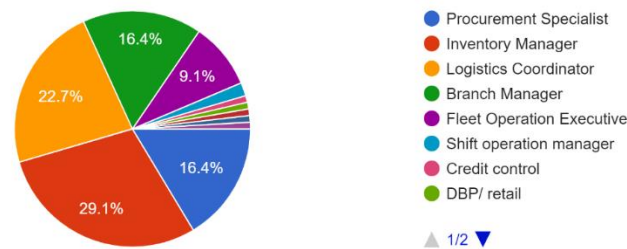


Interpretation

According to this graph 42.7% of people experience in supply chain operation is less than 1 year, 1-3 years people were 32.7%, 15.5% people are experience 4-6% of people and 7 and more than 10 years people were 9.1%.

Which role best describes your position in supply chain operations?

110 responses

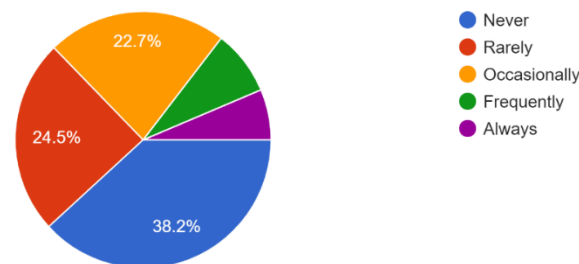


Interpretation

According to this survey the best position in supply chain operation are procurement specialist is 16.4%, inventory manager is 29.1%, logistics coordinator is 22.7%, branch manager is 16.4% and 14.4% are in fleet operation executive, shift operation management, credit control and DBP/retail.

How often do you utilize digital tools/software in your supply chain operations?

110 responses

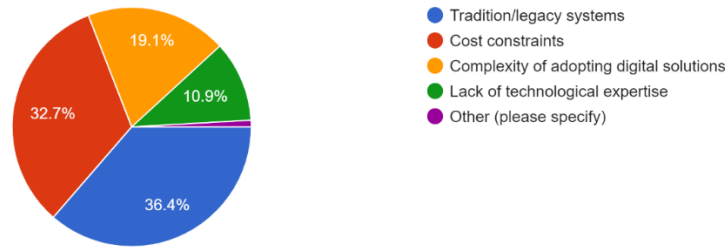


Interpretation

According to this survey 38.2% people never use tools/software, 24.5% people are rarely used, 22.7% of people were use occasionally and 14.6% people were use frequently and always.

What are the primary reasons for using manual methods in your supply chain operations? (Select all that apply)

110 responses

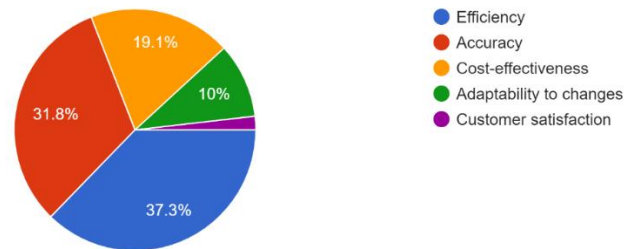


Interpretation

According to this survey the primary reasons for using manual method in supply chain operation is tradition/legacy system which is 36.4%, 32.7% people were use due to cost constraints, 19.1% were due to complexity of adopting digital solutions and 11.8% of people were suffers from lack of technological expertise and others.

How do you perceive the effectiveness of digitization compared to manual methods in terms of:

110 responses

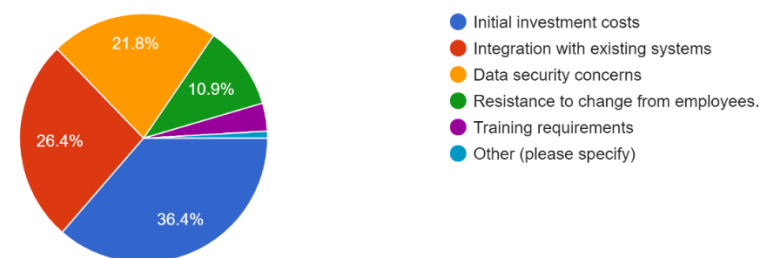


Interpretation

According to this survey, 37.3% were efficiency, 31.8% were accuracy, 19.1% were cost-effectiveness, 10% were adaptability to changes and rest were consumer satisfaction in the effectiveness of digitization compared to manual method .

What are the main barriers or challenges you anticipate in implementing digital solutions in your supply chain operations? (Select all that apply)

110 responses

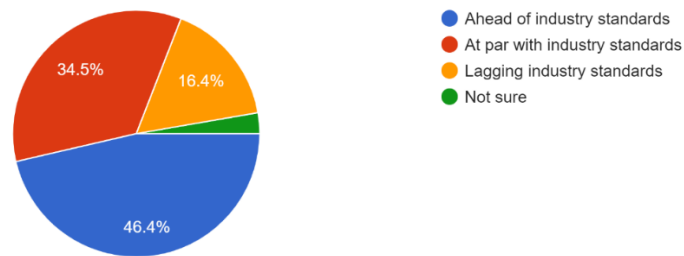


Interpretation

According to this survey, to solve the barriers or challenges supply chain operation by initial investment costs which is 36.4%, integration with existing system which is 26.4%, data security concerns which is 21.8%, resistance to change from employees which is 10.9% and rest were training requirements and others.

How would you rate the level of digitization in your organization's supply chain operations compared to industry standards?

110 responses

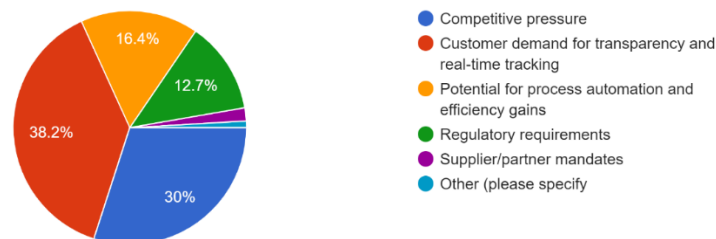


Interpretation

According to this survey, people were rate the level od digitization which is 46.4% were ahead of industry standards,34.5% were at par with industry standards, 16.4% were lagging industry standards and rest were not sure.

What factors influence your organization's decision to adopt digital solutions in supply chain operations? (Select all that apply)

110 responses



Interpretation

According to this survey, the factors influence the organization decision to adopt digital solutions in supply chain operation which is 30% competitive pressure, 38.2% were customer demand for transparency and real-time tracking, 16.4% were potential for process automation and efficiency gains, 12.7% were Regulatory requirements and rest were supplier/partner mandates and others.

HYPOTHESIS TEST -T-TEST

To compare the variations between manual and digitalized methods, inferential statistical tests is done. Typical exams consist of:

T-tests is used to compare the means (e.g., efficiency, accuracy, cost) of two independent sample size of 65.

We will apply the formula for the two-sample independent t-test to determine the t-test for the provided data. We will compute the t-test statistic using the standard error of the difference between means formula, as we know the population standard deviations.

The population standard deviations are known, the following formula can be used to get the standard error of the difference between means (SE):

$$SE = \frac{\sigma}{\sqrt{n}}$$

← Standard deviation (pointing to σ)
← Number of samples (pointing to \sqrt{n})

With this formula, SE calculated is, SE=0.3106,

Now, we compute the t-test statistic:

With 65 samples in each method, we will employ a two-tailed t-test with a significance level ($U\alpha$) of 0.05.

Then, since we're estimating the means from the data and both samples have 65 observations, we compare the calculated t-value (6.43) with the critical t-value from the t-distribution table for a two-tailed test with 64 degrees of freedom.

At a level of significance (α the critical t-value, at α) of 0.05, is roughly ± 1.997 .

Since the calculated t-value (6.43) is far greater than the critical t-value, we reject the null hypothesis.

CONCLUSION:

Strong evidence suggests that the mean cycle time for the manual method differs significantly from the mean cycle time for the digitalized method, as indicated by the t-test results.

To present the results in an intelligible and clear way, use data visualization techniques like graphs, charts are present to make it easier to find and understand with the aid of visual representations.

The digitalized method is more efficient than the manual method in supply chain operations based on the statistical analysis comparing the mean cycle times of the two methods. The digitalized method shows faster processing and possibly smoother operations with a mean cycle time of 6 hours, much less than the manual method's 8 hours. Beyond just cutting cycle time, the digitalized approach might also offer advantages like increased accuracy, real-time monitoring, and scalability. Consequently, in today's quickly changing business environment, adopting digitalization in supply chain operations seems to be the better option for increasing efficiency and maintaining competitiveness.

4.3 Results and Analysis

This chapter presents the findings from surveys that Om Logistic in Pune, Mumbai, administered. The employee responses regarding the associated concerns and problems will aid in gaining understanding and guiding the development of suggestions for improving the process. In response to inquiries concerning supply chain management, manual and digitalization of procedures, and related operations, both staff members and clients provided pertinent answers.

Management systems and apps may easily exchange data electronically. One of the keys, time-saving benefits is that you may input information into the systems once and then reuse the data several times instead of registering the same information for every shipment.

Logistics and technology have converged to provide more collaborative solutions and closer integration between the supply chain and the end-user.

This digital approach not only paves the way for entirely new opportunities for your company to save on operating costs, cut down on productivity losses, and prevent imprecise order fulfilment, but it also raises the level of data transparency for all of the suppliers and partners who are involved in every step of supply chain management and operations management. This can be a huge benefit for your business.

Digital supply chains, on the other hand, are dynamic and quick to adjust to shifting conditions (political unrest, pandemics, market disruptions, and so on). They are extremely flexible "value networks" with integrated systems and procedures that operate in real-time. Every process in the ecosystem has easy access to integrated, timely, and contextual data from operational technology (OT) and information technology (IT) systems in these supply networks. Modern supply chains use state-of-the-art software for logistics management. With the goal of reducing costs and maximizing return on investment, supply chain managers can use these solutions to plan, implement, control, and optimize the flow of materials and goods.

Digitalization is not the next step but the only step in scaling logistic operations to greater heights. It is not a simple task. Digitalization is complex. It involves plenty of moving parts and requires a partner with the expertise and solutions to implement it successfully.

CONCLUSION

Several important findings are reached following the completion of an extensive comparison study between supply chain operations using digitalization and manual methods.

First off, there are many advantages to digitalization over manual methods in terms of effectiveness, precision, affordability, and flexibility. Using digital solutions results in more efficient operations, shorter cycle times, better inventory control, and increased network visibility throughout the supply chain. Second, there is a noticeable trend towards adopting digitalization in order to remain competitive in the fast-paced business environment of today, even though manual methods may still be used extensively in some organizations due to tradition, financial restraints, or technological limitations. To fully realize the potential of digital solutions, issues like upfront investment costs, integration difficulties, data security worries, and employee resistance to change must be successfully resolved.

Furthermore, new technologies that have the potential to transform processes and spur industry innovation, like blockchain, artificial intelligence, machine learning, and the Internet of Things (IoT), are likely to have a significant impact on supply chain operations in the future.

As a result, the comparative study's results highlight how crucial it is for businesses to embrace digitalization as a strategic requirement to maximize supply chain efficiency, boost overall performance, and satisfy changing stakeholder and customer demands in the digital era.

RECOMMENDATIONS

To improve efficiency, agility, and competitiveness in the fast-paced business world of today, it is advised that organizations give priority to the implementation of digital solutions, as demonstrated by the research study that contrasts digitalization and manual methods in supply chain operations. Many advantages come with digitalization, such as increased cooperation among supply chain networks, better visibility, and the ability to make decisions in real time (Christopher, 2016). Organizations can optimize resource utilization, reduce operational risks, and streamline processes by investing in digital technologies like cloud computing, robotic process automation, and artificial intelligence (AI).

Furthermore, to direct the incorporation of digital solutions into every facet of supply chain operations, a thorough digitalization strategy ought to be created (Gattorna & Walters, 2016). This plan should specify important technology investments, correspond with organizational goals and objectives, and provide an implementation schedule. In order to support future growth and innovation, organizations also need to make investments in technological infrastructure and make sure that systems are scalable, flexible, and interoperable (Gattorna & Walters, 2016).

Organizations should prioritize change management initiatives and give staff members the assistance and training they need to adjust to new technologies in order to combat resistance to change and foster an innovative culture (Jacobs & Chase, 2018). Organizations can fully utilize digital solutions and promote long-term business transformation by integrating staff members in the digitalization process and creating a collaborative work environment. In conclusion, firms looking to attain operational excellence, customer satisfaction, and competitive advantage in the current digital economy must implement digitalization in their supply chain operations. Organizations can optimize supply chain performance, seize new opportunities, and prosper in an increasingly complex and interconnected global marketplace by adopting digital technologies and sensible digitalization strategies.

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