*A Project Report on*

# "A STUDY ON MAPPING DIGITAL TECHNOLOGIES IN SUPPLY CHAIN"

*In partial fulfillment of the requirements for the award of the Degree of*

**MASTER OF BUSINESS ADMINISTRATION**

(International Transportation and Logistics Management)

*Submitted by*

**AJU GREGORY**

Reg no.2105305001

*Under the esteemed guidance of*

**Dr. YOGAMALA H L**

Head of the Department


**SCHOOL OF MARITIME MANAGEMENT**

**INDIAN MARITIME UNIVERSITY**

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**SCHOOL OF MARITIME MANAGEMENT**

**Dr. Yogamala H L**

Head of the Department

School of Maritime Management

Indian Maritime University, Kochi Campus

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# CERTIFICATE

This is to certify that the Project titled "A STUDY ON MAPPING DIGITAL TECHNOLOGIES IN SUPPLY CHAIN" submitted by Aju Gregory register number 2105305001 student of MBA ITLM is a bonafide record of his internship report and submitted to the School of Maritime Management, Indian Maritime University, Kochi campus, under the supervision of Dr. Yogamala H L, Head of the Department IMU, Kochi campus. It is also certifying that the above work has not previously formed or submitted for the award of any degree, diploma, associateship, fellowship, or other similar titles, and it is an independent work done by the candidate.

**Dr. Yogamala H L**

10/5/23

# SELF DECLARATION

I, Aju Gregory (Registration No: 2105305001) student of School of Maritime Management, Indian Maritime University, Kochi hereby declares that this project report titled "A STUDY ON MAPPING DIGITAL TECHNOLOGIES IN SUPPLY CHAIN" submitted in partial fulfilment of the requirement for the degree of Master of Business Administration in International Transportation and Logistics Management is my original work carried under the guidance of Dr. Yogamala H L.

I also confirm that the report is only prepared for my academic requirement, not for any other purpose. It might not be used with the interest of the opposite party of the corporation.

Aju Gregory

Reg No: 2105305001

MBA (International Transportation and Logistics Management)

School of Maritime Management (IMU Kochi)

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I appreciate my institution for helping me develop this project, and I am thankful to those who willingly contributed their abilities.

This opportunity is a significant milestone in my career development. I will endeavor to utilize the skills and knowledge gained in the best possible way and continue to work on improving them to achieve my desired career objectives. I look forward to continued cooperation with everyone in the future.

# CONTENTS

# EXECUTIVE SUMMARY

Technology has many benefits for supply chain management, including increased productivity through streamlined tracking and distribution of inventories. The main advantages of technology in this area are cost savings, improved client relations, and better operational efficiency. Digital technologies have revolutionized supply chain management, providing companies with enhanced visibility, real-time data analytics, and increased efficiency. This has resulted in improved inventory management, faster delivery times, reduced costs, and better customer satisfaction. Some of the key digital technologies being used in supply chain management include Internet of Things (IoT) devices, Artificial Intelligence (AI), blockchain, and cloud computing. These technologies enable companies to track shipments, monitor inventory levels, optimize routes, and improve decision-making based on real-time data. However, implementing digital technologies in supply chain management requires a comprehensive strategy, adequate resources, and skilled professionals. Therefore, companies need to carefully evaluate their digital transformation needs and invest in the right technologies to achieve their goals. While the logistics industry has been slower than others to adopt technology, there has been a steady stream of new products and services for supply chain management and logistics operations in recent years. Using technology in logistics procedures can lead to significant cost and operational savings, as it provides real-time data for better visibility and tracking of activities. It also improves collaboration and communication with important vendors and lowers costs. Emerging technologies offer strategic opportunities for businesses to establish competitive advantages across various functional areas, but success depends on choosing the appropriate technology for the application and having the right organizational infrastructure, culture, and management guidelines. Information, communication, and automation technologies have greatly accelerated logistics processes while maintaining accuracy and dependability. Technology improves the efficiency and competitiveness of businesses, leading to increased demand for goods, reduced inventory, and improved efficiency. It also enables businesses to meet customer needs more effectively. To gain an edge in today's competitive business environment, firms must choose the right technology for various logistical activities and sub-processes. The project aims to identify the different technologies used in logistics and supply chain management, including information technology, communication technology, and automatic identification technology, and examine how they have affected supply chain management and logistics.

# CHAPTER 1

# INTRODUCTION

## 1.1 OVERVIEW

A supply chain is a group of people and businesses responsible for producing a product kg getting it to the consumer. The raw material producers are the first links in the chain, and the last is the van that delivers the finished product to the customer. Global supply chains cover everything from the procurement of raw materials to the delivery of goods directly to customers. But because of their intricate structure, every link in the supply chain needs to work properly for goods to arrive on time. Digital supply chains can help with it. Digital supply chains use data analytics to ensure that logistics professionals have access to actionable insights to effectively plan, manage, and strategize supply chains. Digital supply chains use digital technologies to capture big data produced by each step of the process. The ability to gather and evaluate data in real-time is one of the biggest advantages of digital technologies in supply chain management. As a result, businesses may better understand their operations, spot inefficiencies, and streamline the supply chain management procedures. For instance, businesses may follow shipments in real-time, keep an eye on inventory levels, and foresee potential interruptions with the help of the Internet of Things (IoT). Making educated decisions, increasing supply chain visibility, and improving the customer experience may all be done with this information.

Also, businesses may now build a supply chain ecosystem that is more linked and cooperative thanks to digital technologies. Using cloud-based platforms, businesses may share information with suppliers, clients, and logistics service providers, enhancing collaboration and cutting down on lead times. In order to reduce the risk of stockouts and other supply chain disruptions, cloud-based platforms can be used, for example, to manage shipments, exchange manufacturing schedules, and interact with suppliers. The capability of digital technology to automate repetitive processes, so lowering errors and increasing efficiency, is another advantage they offer to supply chain management. RPA, for instance, can be used to automate order processing, inventory management, and invoicing, requiring less manual intervention and freeing up staff for more strategic duties. Several global supply chains lack the tools necessary to survive in the world we are entering. Because of this, supply chain managers must focus less on reducing costs and more on enabling new processes, increasing corporate connectivity, and fostering greater organisational agility. Everyday new digital innovations are on the verge of upending almost all facets of conventional corporate operations. Nearly every industry's top business concern will be at the centre of the approaching digital era. Supply chain management is impacted by the digitalization process, which has a significant impact on many aspects of modern enterprises.

So, it is essential for managers to comprehend how digitalization will affect their business and workforce. The current situation emphasises the significance of organisational and people management concerns in digital transitions. The effects of digitalization on the economy as a whole vary; they present both great potential and difficulties for firms. In today's world of globalisation, digitization is not an option but rather a must for all firms in all sectors. The key goals of digitalization include business models, products, services, and manufacturing processes and operations.

## 1.2 SIGNIFICANCE OF THE STUDY

Digital technologies have irrevocably altered business operations, consumer behaviour, and interactions among all sectors of the economy, which is beyond dispute. Hence, the "always online" mentality and the hyper-connectedness of people, businesses, and machines in the digital economy have been made possible by mobile Internet. The amount of data that social networks collect about each of its users is enormous. Algorithmic decision-making and automated process management are provided by artificial intelligence. Predictive analytics and enormous amounts of structured and unstructured data can be processed thanks to big data technology. All ecosystem participants receive complicated data and knowledge thanks to cloud technologies. Intelligent robots almost entirely replace human involvement in many processes. The use of augmented reality allows for a comprehensive and in-depth understanding of corporate processes. Remote management of systems and processes is made feasible by the Internet of Things, and the blockchain verifies the validity of participants and transactions. Due to their increasing relevance to both present and future supply chains, digital technologies have acquired popularity among businesses, researchers, and policymakers in recent years. The manufacturing, process industry, and logistics sectors are evolving as a result of technologies like robots, artificial intelligence, autonomous transport systems, data science, and additive manufacturing that are becoming ingrained in people's and businesses' daily lives. Although there have been recent attempts to comprehend how these technologies may affect supply chain management, it is still unclear how relevant the various technologies will be in the future. The most significant enabling technologies for supply chains through 2030 are found and chosen, and their effects on future supply networks are assessed using an assessment methodology with various evaluation criteria.

The goal of supply chain digitalization in a circular economy is to provide the necessary data on critical components and business processes, bottlenecks and interruptions, as well as options for optimising key indicators for efficient resource use and cost reduction to achieve social, economic, and environmental goals. In reducing costs and minimising the negative consequences of production and consumption, digital technologies assist in the creation of innovative supply chains that consider the product life cycle and its impact on the environment both during the production process and during use.

## 1.3 SCOPE OF THE STUDY

The scope of a study is to examining how digital technologies are being used in various aspects of the supply chain, including procurement, manufacturing, transportation, warehousing, and distribution. This would include looking at the types of digital technologies being used, such as cloud computing, big data analytics, the Internet of Things (IoT), blockchain, and artificial intelligence (AI). The study would also investigate how these technologies are being implemented, their benefits, and any challenges associated with their adoption. Additionally, the study could explore the impact of digital technologies on the overall efficiency, transparency, and sustainability of the supply chain.

## 1.4 OBJECTIVE OF THE STUDY

- Identifying and analysing the various digital technologies that are currently being used in supply chain management.
- Examining the impact of digital technologies on supply chain performance.
- Assessing the challenges and barriers to the adoption of digital technologies in supply chain management.
- Exploring best practices for the implementation and management of digital technologies in supply chain management.

## 1.5 RESEARCH METHODOLOGY

The research will be conducted by utilising existing data that has already been gathered analysed by others for different purposes. This data may be obtained from various sources such as government bodies, research institutions and private organisation.

## 1.6 DATA COLLECTION

Secondary Data

- Books, magazines and newspaper.
- Websites.
- Research articles.
- Journal.

## 1.7 LIMITATIONS OF THE STUDY

• Limited time span of the project.

• Sources for collecting data were very limited.

• Some of the data are also not available because the site is not reliable.

• Financial constrains.

# CHAPTER 2

# LITERATURE REVIEW

## 1. The link between information and digital technologies of industry 4.0 and agile supply chain: Mapping current research and establishing new research avenues

*Di´essica Oliveira-Dias, Juan M. Maqueira-Marín , Jos´e Moyano-Fuentes*

Designing and maintaining agile supply chains now faces new opportunities and problems as a result of the usage of Industry 4.0 (I4.0) information and digital technologies (IDT). By a thorough examination of the literature, this study seeks to analyse the function and significance of IDT of I4.0 for the Agile Supply Chain (ASC) strategy. Based on the Technological Life Cycle, the literature has been divided into three research areas: Mature IDT of I4.0 and ASC; Emerging IDT of I4.0 and ASC; and A Generic Approach to the Role and Implications of IDT of I4.0 and ASC. This classification provides a thorough examination of the connection between it clarifies the relationship between the IDT of I4.0 and Agile Supply Chain as well as how the study has developed.

## 2. Digital Supply Chain: Literature review and a proposed framework for future research

*PanelGülçin Büyüközkan, Fethullah Göçer*

Information is used, produced, and shared by suppliers, partners, businesses, and dealers in supply chains. The supply chains are impacted by a wide range of opportunities and difficulties as a result of these relationships. A digital supply chain (DSC) is a clever, value-driven process that uses cutting-edge technology and analytical techniques to develop new sources of revenue and commercial value for enterprises. DSC is concerned with how supply chain processes are managed using a wide range of cutting-edge technologies, such as unmanned aerial vehicles, cloud computing, and the internet of things, among others. It is not about whether goods and services are digital or physical. Several industrial researchers talk about the uses of DSC, and recent literature emphasises its significance. This article provides a thorough evaluation of the most recent DSC literature from both academic and commercial perspectives. It outlines existing research, identifies information gaps, and highlights significant DSC constraints and opportunities by outlining the benefits, drawbacks, and restrictions of various methodologies. The paper also intends to offer a framework for development as a guide for upcoming study and practise.

## 3. The Architecture of Supply Chain Digitalisation Research

*Zahra Seyedghorban , Hossein Tahernejad , Roy Meriton, Gary Graham*

A completely interconnected ecosystem is being developed as a result of the fourth industrial revolution. Companies are currently redesigning their strategies, including supply chain management, to become completely transparent. Supply chain digitalization is beginning to draw more attention, but it's unclear where its study stands right now. We conducted this research to determine what determines what subjects have been studied, what questions have been asked, and what topics that require more study, how to categorise the body of material already published, and how the field is able to proceed. We used a mixed-methods strategy that combined quantitative and qualitative research strategies to make this happen. In order to determine the underlying knowledge

foundation and evolution of supply chain digitalization, current emphasis, and grouping of research into various clusters, a bibliometric analysis of 331 papers with 12709 references was first carried out. Moreover, to examine our quantitative findings, content analysis was used to undertake a qualitative review.

## 4. Digital Supply Chain: Survey of the Literature

*Faisal Iddris faisal, Halmstad, Sweden*

The purpose of this study is to present a body of existing information on the digital supply chain (DSC) and to open up possibilities for future research. Findings—Based on the study of the 60 articles, the report concludes that technologies, digitization, integration, collaboration, and coordination are the primary forces behind the development of the digital supply chain. The study showed that the most dominant research approach employed was survey-type research (40 percent). The conclusion is that academics must use qualitative case studies to investigate the evolution of DSC empirically, as this could result in high-level conceptualization and theoretical advancement in the DSC field. The research also showed that 73.3 percent of the publications did not explore any theoretical underpinnings. For the conceptualization and theory development in the area of digital supply chain, this review thus serves as a foundation. Originality/Value-Supply chain management has had some appraisals generally, but Scholars have made little attempts to synthesise the body of work on the digital supply chain. The purpose of this study is to give a body of prior information about the digital supply chain and offers chances for additional investigation.

## 5. The adoption of digital technologies in supply chains: Drivers, process and impact

*Miying Yang, Mingtao Fu, Zihan Zhang*

The adoption of digital technologies in manufacturing firms at the supply chain level has not been extensively studied, despite extensive research in academia and industry. This study aims to address this gap by investigating the drivers of digital technology adoption in manufacturing firms, the process of adoption, and the resulting impact on supply chains. Through a literature review, the study identifies four aspects of the impact on supply chains: supply chain efficiency, supply chain structure, sustainability, and innovation. The study proposes a conceptual framework that includes driver, process, and impact, and discusses their inter-relationships. The study highlights technological intelligence and supply chain cooperation as key factors and proposes two-dimensional levels of adopting digital technologies based on low-to-high degrees. This framework, particularly the levels of adoption, is a novel contribution to the existing literature and can serve as a basis for further empirical studies. The study provides guidance for practitioners in developing appropriate business strategies for supply chain management at different levels of digitalization.

## 6. The digitalization of supply chain: a review

*Barbara Bigliardi, Serena Filippelli, Alberto Petroni, Leonardo Tagliente*

The emergence of new digital technologies as part of Industry 4.0 has enabled the supply chain to be managed more efficiently. We talk about digitalization of the supply chain and this trend refers to the evolution towards a smarter model that involves digital technologies such as Blockchain, IoT, Machine Learning, etc. These technologies actually increase and enhance the ability to optimize planning, sourcing and procurement strategies. Since this topic is of relevant interest for the scientific community, this paper aims to investigate the main discussion themes related to supply chain digitalization using a keyword-based organizing framework to identify, classify and investigate relevant intellectual contributions in this field.. Results showed which are the main issues regarding supply chain digitalization as well as promising future research avenues.

# CHAPTER 3

# INDUSTRY PROFILE

## 3.1 SUPPLY CHAIN INDUSTRY

The supply chain industry plays a critical role in the global economy, serving as the backbone of the movement and delivery of goods and services across the world. Over the years, the industry has undergone significant evolution, driven by technological advancements, changing consumer behaviour, and global economic shifts. A supply chain transforms raw materials and components into a finished product that's delivered to a customer. It is made up of a complex network of organizations and activities, such as raw materials suppliers, manufacturers, distributors, retailers and the customer. Supply chain management is the orchestration between these networks comprising procurement, management and storage of raw materials and manufacturing, as well as the moving, delivery, and storing of finished goods and after-market services to create maximum efficiency, lower cost and net value. One of the most significant drivers of supply chain industry evolution has been globalization. The rise of globalization has led to the expansion of supply chain networks across borders and increased the complexity of supply chain operations. This has created the need for improved communication, collaboration, and visibility across supply chain partners. In response, companies have implemented new technologies, such as cloud-based collaboration platforms, to improve supply chain management and enhance visibility across the entire supply chain. To understand the importance of supply chains management, it's worth first thinking about the importance of a supply chain at its most basic level. Traditional supply chains follow a linear progression. The output of one step is typically the input of the next step. For instance, suppliers must send raw materials to the manufacturer before the products can be made. If there's a problem at any step, the entire linear chain is disrupted. Today's supply chains, however, are more complex than linear models—they're sophisticated supply networks that are more flexible and efficient. This helps meet customer expectations for a wide selection of customized, sustainable products and fast deliveries that meet individuals' specific needs.

Mapping out a supply chain is one of the critical steps in performing an external analysis in a strategic planning process. The importance of clearly laying out the supply chain is that it helps a company define its own market and decide where it wants to be in the future. In developing corporate-level strategies, a company often needs to make decisions on whether to operate a single line of business or enter into other related or unrelated industries. Each stage of a supply chain is essentially a different industry, for example, raw material extraction and manufacturing. The supply chain enables a company to understand others that are involved in each of the stages, and thereby provides some insights on the attractiveness or competitiveness in industries the company might want to enter in the future. Technology has also been a significant driver of supply chain industry evolution. Innovations such as RFID, IoT, AI, and blockchain have transformed how goods are tracked, managed, and delivered. This has led to increased efficiency, cost savings, and improved customer satisfaction. For example, RFID technology enables companies to track products in real-time, allowing them to quickly identify and resolve supply chain issues, while AI-powered predictive analytics help optimize inventory levels, reducing costs and improving supply chain responsiveness. The growth of e-commerce has also disrupted the supply chain industry, requiring companies to become more flexible and responsive to changing consumer demands. This has increased the focus on last-mile delivery, with companies investing in new technologies, such as drones and autonomous vehicles, to improve delivery times and reduce costs. Additionally, e-commerce has led to the

development of new supply chain models, such as drop-shipping and direct-to-consumer fulfillment, which require new approaches to inventory management and delivery.

Sustainability has also become a significant driver of supply chain industry evolution, with companies implementing strategies to reduce waste, minimize carbon emissions, and ensure ethical sourcing. This has led to the development of new supply chain models, such as circular supply chains and closed-loop supply chains, which focus on reducing waste and maximizing the use of resources. Additionally, companies are leveraging technology to improve sustainability, such as using AI-powered predictive analytics to optimize supply chain routes, reducing fuel consumption and carbon emissions. Customer expectations have evolved, with customers demanding faster delivery times, more transparency, and greater convenience. This has forced companies to adopt new technologies, such as predictive analytics, to improve demand forecasting and optimize inventory management. Additionally, companies are leveraging technology to enhance customer experience, such as using chatbots and virtual assistants to provide personalized and responsive customer service. The supply chain industry continues to evolve rapidly, with new technologies and trends driving change and disruption across the sector. Companies that are able to adapt and innovate will be best positioned to succeed in this dynamic and challenging environment. The future of the supply chain industry is likely to be characterized by increased digitization, enhanced collaboration, and greater focus on sustainability, with companies leveraging new technologies to improve efficiency and drive growth.

## 3.2 DIGITALIZATION OF SUPPLY CHAIN

The supply chain is a complex network of interconnected activities, spanning from procurement and production to transportation and distribution, and ultimately reaching the end customers. Traditionally, supply chain management has relied on manual processes and paper-based systems, resulting in inefficiencies, delays, and lack of visibility. However, with the advent of digital technologies, the landscape of supply chain management is rapidly evolving, and digitalization is emerging as a transformative force that is revolutionizing the future of logistics. Digitalization of supply chain refers to the integration of digital technologies, data analytics, and automation to streamline and optimize supply chain processes, enhance visibility, enable data-driven decision-making, and foster collaboration among supply chain partners. From end-to-end visibility to real-time data analytics, digitalization is reshaping every aspect of the supply chain, offering unprecedented opportunities for businesses to drive operational efficiencies, gain competitive advantages, and adapt to the ever-changing business landscape.

The Industrial Revolution saw a transformation in industrial methods and technologies, with three distinct periods of change. The first revolution began in the 18th century with the introduction of steam power and automation, which led to the growth of factories and urbanization. The second revolution started in the 19th century and included mechanization of agriculture, the textile industry, railroads, machinery, internal combustion engines, and electric power. The third revolution, beginning in the 1950s, saw the introduction of transistors and microprocessors, which led to the integration of computers and electronic devices into manufacturing facilities. Supply chain and logistics management has also undergone significant changes, extending beyond traditional limits

and facing daily challenges aimed at boosting business growth and competitiveness. This includes internal and external elements that place strain on a business's day-to-day operations. A 2017 study found that over 70% of survey respondents from 17 countries stated that their supply chain was "very" or "very" complicated, making extended supply chain visibility difficult.

## 3.3 IMPACT OF DIGITAL TECHNOLOGIES

- Enhanced visibility

  Real-time visibility across the entire supply chain, from sourcing to delivery, provides organizations with critical insights into inventory levels, shipment status, and logistics operations. This enables proactive management of supply chain disruptions, such as delays or stockouts, and allows for timely corrective actions, such as rerouting shipments or adjusting production plans. Improved visibility also facilitates better demand forecasting and inventory management, leading to reduced stockouts, excess inventory, and carrying costs.

- Data-driven decision-making

  Advanced analytics and machine learning algorithms enable organizations to collect, analyse, and utilize vast amounts of data generated within the supply chain. This data can be used to gain insights into customer preferences, market trends, and supplier performance, among other factors. With data-driven decision-making, organizations can make informed and strategic decisions on procurement, production planning, transportation optimization, and demand forecasting. This leads to more accurate and timely decision-making, reducing costs and improving operational efficiencies.

- Automation and optimization

  Automation of repetitive and manual tasks, such as order processing, inventory replenishment, and shipment tracking, eliminates errors, delays, and redundancies, leading to improved process efficiency. Digitalization also enables optimization of supply chain processes, such as route optimization, warehouse layout design, and production planning, resulting in improved productivity, reduced costs, and better resource utilization. Automation and optimization help organizations achieve higher levels of operational excellence and drive competitive advantages.

- Collaboration and connectivity

  Cloud-based platforms, electronic data interchange (EDI), and application programming interfaces (APIs) enable seamless sharing of data and information among supply chain partners, including suppliers, manufacturers, logistics providers, and customers. This fosters collaboration, coordination, and communication among stakeholders, leading to better

visibility, improved order management, and increased agility in responding to changing market dynamics. Collaborative digital platforms also facilitate supply chain innovation, allowing for joint problem-solving, shared data analytics, and co-creation of value-added services.

- Innovation and agility

  Emerging technologies, such as the Internet of Things (IoT), blockchain, and artificial intelligence (AI), are being leveraged to create new business models and enhance supply chain capabilities. For example, IoT devices can provide real-time data on shipment conditions, warehouse temperature, and equipment status, enabling proactive monitoring and management. Blockchain can provide end-to-end visibility and traceability, enhancing transparency and trust in the supply chain. AI-powered algorithms can enable predictive analytics for demand forecasting, route optimization, and risk management. These innovative technologies allow organizations to stay ahead of the competition, adapt to changing customer demands, and drive continuous improvements in the supply chain.

## 3.4 MAPPING OF VARIOUS DIGITAL TECHNOLOGIES WITH SUPPLY CHAIN SUBFUNCTIONS

### **3.4.1** PROCUREMENT

Procurement is the process of acquiring goods and services from external sources, and it is a critical function within the supply chain. Digital technologies have transformed the procurement function in recent years, allowing companies to automate many of the manual tasks involved in the procurement process, and to leverage data and analytics to make better purchasing decisions.

Some of the digital technologies that are transforming procurement include:

- E-procurement systems: These are online platforms that enable companies to automate and streamline the procurement process, from sourcing suppliers to issuing purchase orders and tracking deliveries.
- Spend analysis tools: These tools enable companies to analyse their spending patterns and identify areas for cost savings and process improvements.
- Contract management software: This software allows companies to manage contracts with suppliers, including creating and storing contracts, tracking milestones, and monitoring compliance.
- Supplier relationship management (SRM) tools: These tools enable companies to manage their relationships with suppliers, including tracking performance, managing contracts, and collaborating on projects.
- Electronic sourcing tools: These tools allow companies to automate the process of sourcing suppliers, from issuing requests for proposals to evaluating bids and selecting suppliers.

- Artificial intelligence (AI) and machine learning (ML): These technologies are being used in procurement to automate routine tasks, such as processing purchase orders and invoices, and to analyse data to identify opportunities for cost savings and process improvements

### **3.4.2** PRODUCTION PLANNING

Production planning is an important aspect of supply chain management that involves the creation of a production plan that outlines the steps necessary to manufacture and deliver products to customers. The process involves analysing demand, determining the necessary resources, and scheduling production to meet customer needs. Digital technologies play a crucial role in production planning and the broader supply chain. These technologies include:

- Enterprise Resource Planning (ERP) systems: These systems integrate data and processes across an organization, allowing for real-time visibility into inventory levels, production schedules, and demand forecasts. This information can help manufacturers optimize their production planning and make better decisions about resource allocation.
- Manufacturing Execution Systems (MES): These systems provide real-time monitoring of the production process, enabling manufacturers to track progress, identify bottlenecks, and make adjustments to ensure efficient production.
- Advanced Analytics: These tools use machine learning and other advanced algorithms to analyze data and identify patterns that can inform production planning decisions. For example, predictive analytics can help manufacturers forecast demand and adjust production schedules accordingly.
- Internet of Things (IoT): IoT devices can be used to track inventory levels, monitor equipment performance, and collect data on production processes. This data can be used to optimize production planning and improve efficiency.
- Cloud Computing: Cloud-based technologies can provide manufacturers with access to real-time data and analytics from anywhere, allowing for more flexible production planning and supply chain management.

### **3.4.3** INVENTORY MANAGEMENT

Inventory management is the process of overseeing the flow of goods and materials from suppliers to warehouses, through production, and ultimately to customers. Effective inventory management involves maintaining optimal levels of inventory to meet demand while minimizing the cost of holding excess inventory. Digital technologies have revolutionized inventory management by providing greater visibility into inventory levels, enabling real-time tracking of inventory movements, and automating many aspects of inventory management. Some of the key digital technologies used in inventory management include:

- Barcode scanning and RFID: These technologies enable real-time tracking of inventory movements and can help reduce errors in inventory management.
- Inventory management software: This software enables companies to track inventory levels, monitor demand, and forecast future inventory needs. It also helps automate the process of reordering inventory when levels fall below a certain threshold.
- Cloud-based inventory management: Cloud-based technologies provide companies with access to real-time inventory data from anywhere, allowing for more flexible inventory management.
- Internet of Things (IoT): IoT sensors can be used to monitor inventory levels and alert warehouse managers when inventory levels fall below a certain threshold.
- Artificial Intelligence (AI) and Machine Learning: AI and machine learning algorithms can be used to analyze data on inventory levels, demand patterns, and supplier performance to optimize inventory management decisions.

### **3.4.4** WAREHOUSING AND DISTRIBUTION

Warehousing and distribution are critical components of the supply chain that involve the storage and movement of goods from suppliers to customers. Effective warehousing and distribution require efficient processes, accurate inventory management, and timely delivery. Digital technologies have transformed warehousing and distribution by providing greater visibility into inventory levels, enabling real-time tracking of goods, and automating many aspects of the process. Some of the key digital technologies used in warehousing and distribution include:

- Warehouse Management Systems (WMS): WMS software helps optimize warehouse operations by providing real-time visibility into inventory levels, managing inventory movements, and automating many warehouse processes.
- Automated Storage and Retrieval Systems (ASRS): These systems use robotics and automation to move goods around the warehouse, improving efficiency and reducing errors.
- Autonomous Mobile Robots (AMRs): AMRs can be used for automated order picking, inventory replenishment, and other warehouse tasks, improving efficiency and reducing labour costs.
- Transportation Management Systems (TMS): TMS software helps optimize transportation operations by managing carrier selection, route planning, and delivery scheduling.
- Internet of Things (IoT): IoT sensors can be used to monitor the location and condition of goods in real-time, improving inventory accuracy and reducing the risk of lost or damaged goods.
- Augmented Reality (AR) and Virtual Reality (VR): AR and VR technologies can be used for warehouse training and to improve order picking accuracy

### **3.4.5** CUSTOMER SERVICE

Customer service is a crucial aspect of the supply chain that involves managing customer relationships, responding to customer inquiries and complaints, and ensuring timely delivery of products. Effective customer service can help improve customer satisfaction, reduce the risk of customer churn, and generate positive word-of-mouth. Digital technologies have transformed customer service in the supply chain by enabling companies to provide faster, more personalized service to customers. Some of the key digital technologies used in customer service include:

- Customer Relationship Management (CRM) software: CRM software enables companies to track customer interactions, manage customer data, and provide personalized service to customers.
- Chatbots and virtual assistants: These tools use artificial intelligence to provide 24/7 customer support, answer common customer questions, and help customers find the information they need.
- Social media: Social media platforms can be used to engage with customers, respond to inquiries and complaints, and provide updates on delivery status.
- Mobile apps: Mobile apps can be used to provide customers with real-time updates on their order status, track shipments, and provide personalized recommendations.
- Analytics and machine learning: These technologies can be used to analyze customer data, identify patterns, and make personalized recommendations to customers.

### **3.4.6** QUALITY CONTROL

Quality control is the process of ensuring that products and services meet customer expectations and adhere to quality standards. Effective quality control involves monitoring product and service quality at every stage of the supply chain, from sourcing raw materials to final delivery. Digital technologies have revolutionized quality control in the supply chain by providing greater visibility into product quality, enabling real-time monitoring, and automating many aspects of the process. Some of the key digital technologies used in quality control include:

- Internet of Things (IoT) sensors: IoT sensors can be used to monitor product quality in real-time, providing early warnings of defects or quality issues.
- Quality Management Systems (QMS): QMS software enables companies to manage quality standards, track quality incidents, and automate quality control processes.
- Machine learning and artificial intelligence (AI): These technologies can be used to analyze data on product quality, identify patterns and trends, and make predictions about product quality issues.
- Supplier management software: This software can be used to manage supplier quality, track supplier performance, and monitor supplier compliance with quality standards.
- Digital inspection tools: Digital inspection tools, such as digital cameras and scanners, can be used to collect data on product quality and ensure compliance with quality standards

### **3.4.7** DEMAND PLANNING AND FORCASTING

Demand planning and forecasting is the process of predicting future demand for products and services. Effective demand planning and forecasting help companies optimize inventory levels, reduce stockouts, and ensure timely delivery of products. Digital technologies have transformed demand planning and forecasting by providing greater accuracy and speed in predicting future demand. Some of the key digital technologies used in demand planning and forecasting include:

- Machine learning and artificial intelligence (AI): These technologies can analyze historical sales data, market trends, and external factors, such as weather or economic conditions, to make accurate demand forecasts.
- Big data analytics: By analysing large volumes of data, companies can gain insights into customer behaviour, market trends, and other factors that impact demand.
- Cloud-based demand planning software: Cloud-based software enables companies to access real-time data and collaborate with suppliers and partners, improving the accuracy of demand forecasts.
- Internet of Things (IoT) sensors: IoT sensors can be used to collect data on product usage, providing real-time insights into customer demand.
- Collaborative planning, forecasting, and replenishment (CPFR) software: CPFR software enables companies to collaborate with suppliers, partners, and customers to share demand forecasts and optimize inventory levels.

### **3.4.8** SUPPLY CHAIN ANALYTICS

Supply chain analytics is the process of using data and analytics to gain insights into supply chain operations, identify inefficiencies and opportunities for improvement, and make data-driven decisions. Effective supply chain analytics can help companies optimize inventory levels, reduce costs, and improve overall supply chain performance. Digital technologies have transformed supply chain analytics by providing greater access to real-time data, enabling automation, and improving the accuracy of data analysis. Some of the key digital technologies used in supply chain analytics include:

- Big data analytics: By analysing large volumes of data, companies can gain insights into supply chain operations, identify inefficiencies and opportunities for improvement, and make data-driven decisions.
- Machine learning and artificial intelligence (AI): These technologies can be used to analyze supply chain data, identify patterns and trends, and make predictions about future supply chain performance.
- Supply chain visibility software: Supply chain visibility software enables companies to track the movement of goods throughout the supply chain, providing real-time insights into supply chain performance.

- Digital twin technology: Digital twin technology creates a virtual replica of the supply chain, enabling companies to test different scenarios and identify potential problems before they occur.
- Blockchain technology: Blockchain technology can be used to create a secure, transparent, and decentralized supply chain network, improving supply chain visibility and reducing the risk of fraud and errors.

## 3.5 TECHNOLOGIES USED IN SUPPLY CHAIN MANAGEMENT

### **3.5.1** ARTIFICIAL INTELLIGENCE (AI)

AI refers to the use of algorithms that empower computers to solve problems, make decisions, and execute tasks that are similar to those performed by humans. This approach mimics human thought and behavior in machines. The emergence of Industry 4.0 has been driven by the integration of several digital and software technologies. Although AI has been around since the 1940s, it has undergone numerous incremental improvements, which have enabled its widespread adoption across virtually all industries in the past decade. By leveraging AI in supply chain management, businesses can increase their productivity and efficiency by providing a comprehensive, end-to-end solution from purchasing to sales. AI's ability to quickly analyze vast amounts of data and provide detailed insights makes it a valuable tool in this area.

The end-to-end supply chain benefits from AI and machine learning by:

- Tightening data Security
- Applying predictive modelling to third-party logistics.
- Providing full supply chain visibility to improve management of key
- performance indicators (KPI).
- Automating inventory management, shipping transactions and delivery routing.
- Improving customer service.

### **3.5.2** INTERNET OF THINGS (IOT)

The modern supply chain faces numerous challenges such as regional issues, changing customer demands, and technological advancements. The Internet of Things (IoT) technology has been identified as a crucial tool in improving supply chain management and creating smart industrial ecosystems. IoT connects physical objects, machines, and people to create a network that provides unprecedented visibility and real-time data for predictive and preventive analysis. It enhances collaboration, enables remote management, and facilitates data-driven decision-making. IoT technology has already demonstrated its potential in the food and perishable goods supply chain by offering real-time monitoring of production planning, inventory management, temperature, pressure, and humidity inside shipping containers, as well as tracking the exact location of goods at various

stages. It also aids in reducing wastage and scarcity of such products through appropriate inventory management models

### **3.5.3** BIG DATA ANALYTICS

Big Data Analytics (BDA) is the process of analyzing large volumes of data collected from various sources such as IoT devices, smart sensors, and social media. This data can be structured, semi-structured, or unstructured and can take different forms like numbers, texts, images, or audio files. By using mathematical and statistical methodologies, BDA can provide insightful information on market trends, customer preferences, and other patterns that can help businesses make data-driven decisions. In the supply chain, BDA can be used for descriptive, predictive, preventative, and prescriptive analytics to manage issues like equipment maintenance, inventory management, and manufacturing automation. However, there are four crucial requirements to enable BDA in an organizational supply chain, which are developing data generation capabilities, integrating data across all supply chain functions, developing appropriate analytics capabilities, and creating a data-driven culture. BDA can be particularly useful in areas like quality control, cash flow, real-time deployment, warehouse efficiency, weather patterns, predictive strategies, and inventory management.

### **3.5.4** BLOCK CHAIN

Block chain technology is a decentralized and distributed digital ledger used to store transactions that cannot be changed. It is a combination of different technologies, including computing, networking, cryptography, and mathematics. The technology's unique qualities, such as immutability, decentralization, distributed ledgers, and consensus procedures, make it appealing for various applications where transactions are conducted. Supply chain management is one area where block chain technology can be utilized to manage the complexity of the external, operational, and downstream phases.

Currently, most businesses do not have a robust system to monitor a product's life cycle from raw material to the client, and many important supply chain processes still rely on outdated standalone technologies, which can decrease the supply chain's performance and make it vulnerable to hacking. However, by incorporating block chain technology across all supply chain network participants, suppliers, manufacturers, logistics service providers, distributors, wholesalers, and retailers, data can be collected from all sources and stored in a single location that can be accessed directly without middlemen. Only authorized participants can read or add information. The technology also enables digital verification of asset holding, which can prevent counterfeiting and dual contracting.

Block chain technology can collect data from various technologies such as sensors, GPS, RFID tags, NFC, barcodes, QR codes, APIs, and IoT-enabled devices. The technology can improve supply chain efficiency, customer satisfaction, cooperation, information sharing, financial transactions, trust, transparency, and accountability. The technology can also emphasize data on quality, raw material sourcing sites, and avoiding unethical behaviors that are currently hidden from customers.

Block chain technology offers advantages such as improving product or service traceability, supply provenance to ensure product source and quality, providing transparency and security to data, supporting a circular economy, assuring compliance and ethical practices, error-free inventory management, shipping details, and preventing duplicate payments in supply chain management. Additionally, the technology has potential applications such as asset tracking and self-executing smart contracts that can significantly assist multi-organizational organizations like supply chain, logistics, and finance units.

### **3.5.5** AUTOMATION AND ROBOTICS

The terms "automation" and "robotics" are often used interchangeably, but there is a distinction between them. Automation refers to the use of software, machines, or technology to complete a task with minimal human intervention, while robotics involves programmable machines that can replace humans in labor-intensive, monotonous, or dangerous environments. Automation typically refers to a specific-purpose program or system that performs a single task, whereas robots can perform a variety of tasks. There are three basic types of automation: software automation, robotic process automation (RPA), and industrial automation. Robots can be categorized as semi-autonomous or autonomous. Robotics has traditionally been used to automate specific activities in production environments, but its adoption in other supply chain functions has been hindered by technological and organizational challenges. However, the introduction of Industry 4.0 technologies such as Artificial Intelligence, smart sensors, machine vision, the Internet of Things (IoT), and additive manufacturing has facilitated the advancement of robotics in industrial systems.

Autonomous robots are expected to play a critical role in supply chain and logistics management, and next-generation collaborative robots (COBOTS) allow for collaboration with intelligent humans. COBOTS are small, affordable, and flexible, making them capable of adjusting to shifting demands. Efficient, adaptable, and cost-effective future industries will incorporate automation and robotics as a vital component of their self-steering supply chains. Cutting-edge technologies such as machine vision, smart sensors, advanced algorithms, and neural networks improve a robot's ability to learn autonomously, adapt to changing requirements, and be agile. This distinguishes traditional industrial robots from the new-generation COBOTS. COBOTS are expected to be deployed throughout the supply chain, replacing humans in complicated and mundane tasks. The use of automation and robotics in supply chain applications, such as manufacturing, intra-logistics, material handling, assembly lines, warehousing, packaging, and delivery, is expected to grow rapidly in the coming years

### **3.5.6** ADDITIVE MANUFACTURING

In the 1980s, a new technology called additive manufacturing (AM) was created to replace traditional manufacturing methods like casting, machining, and injection molding. It involves building up layers of material to create a finished product directly from a 3D CAD model. AM is versatile in using a

wide range of raw materials and can be used for prototyping, simplifying assembly, and producing goods in small batches. With the advent of Industry 4.0 technologies, AM is expected to provide high levels of automation and customization. The COVID-19 outbreak disrupted industrial organizations, but AM technology helped to offset these disruptions by increasing the production of essential medical implants, reducing lead times for aerospace and defines applications, and cutting down the time it took to create complex and highly customized parts. Product-based businesses can quickly adapt to changes in demand, with faster development times, lighter components, and lower inventory costs. AM can also reduce the overall energy needed to create parts and help businesses meet their goals for sustainable manufacturing

### **3.5.7** AUTOMATIC IDENTIFICATION TECHNOLOGY

The practice of directly inputting data into computer systems, programmable logic controllers, or microprocessor-controlled devices without using a keyboard is known as Auto ID. This includes technologies such as Bar Coding, Radio Frequency Identification (RFID), and voice recognition. Auto ID is useful for tracking various items, such as packages and containers, and offers benefits such as accuracy, cost savings, and efficient data processing and storage. Bar coding is one of the most common Auto ID methods and is mainly used for tracking and locating specific products. A single barcode can provide access to a lot of information, such as packaging instructions and routing details. Bar coding consists of a series of parallel lines with varying thicknesses that represent encoded information, which can be scanned and read by machines. The advantages of bar coding include easy identification of inventory items during storage, retrieval, inspection, and dispatch. It reduces paperwork and processing time, minimizes human error, and increases productivity in logistics systems through its speed, accuracy, and reliability.

### **3.5.8** ELECTRONIC DATA INTERCHANGE (EDI)

EDI technology enables the transfer of business papers such as invoices, checks, and challans between computers without the need for physical paper. This technology facilitates paperless transactions, as opposed to email messages that are created and interpreted manually. Unlike email, EDI messages are created and interpreted using specialized software, and are structured for efficient data exchange. Additionally, EDI messages can be admissible as legal evidence. The use of EDI technology in supply chain and logistics provides numerous benefits, including faster real-time document transfers, the ability to adopt just-in-time manufacturing techniques, reduced transaction costs through paperless operations, shortened order cycles, lower inventory levels, and improved relationships between trading partners in the supply chain. These advantages also help to create obstacles for competitors, thereby enhancing the competitiveness of customers

### **3.5.9** INFORMATION DIRECTED SYSTEM (IDS)

The material handling machinery is controlled by a computer system, which communicates with the hardware using radio frequency. The computer is given instructions for the required movements, and it assigns tasks to different equipment based on their speed and loading capacity. IDS is capable of managing complex material handling tasks, including multiple order picking and truck loading, using the same equipment, which results in improved productivity in the warehouse

### **3.5.10** DIGITAL SUPPLY CHAIN TWIN

A digital supply chain twin is a virtual model of a physical supply chain that is created by integrating data from various sources, including sensors, enterprise resource planning (ERP) systems, and other relevant technologies. The twin allows for real-time tracking and analysis of the supply chain, enabling organizations to optimize their operations and make informed decisions. By using the digital twin, businesses can simulate various scenarios and test their impact on the supply chain, allowing for greater efficiency and agility in response to changes in demand or disruptions in the supply chain. The digital twin also facilitates collaboration among stakeholders across the supply chain, improving communication and coordination.

# CHAPTER 4

# SWOT ANALYSIS

SWOT analysis is a tool that helps individuals and organizations identify their strengths, weaknesses, opportunities, and threats in relation to project planning or competitive business environments. It is also known as situational analysis or evaluation, and it is used in the early stages of decision-making processes to evaluate the strategic position of various types of organizations, including for-profit enterprises, governments, and NGOs. The aim is to identify internal and external factors that can help or hinder the achievement of project or venture objectives. Using a SWOT analysis can help individuals and organizations gain a fresh perspective on their company and develop or improve their business plan. In business, opportunities and threats are usually seen as external factors, while strengths and weaknesses are viewed as internal factors. Strategic fit refers to how well a company's internal strengths match its external opportunities. Internal factors are classified as strengths or weaknesses based on their impact on the organization's goals. A factor that may be a strength for one objective may be a disadvantage, such as competition or distractions, for another.

## **4.1** STRENGTHS

The use of technology and efficient practices in managing supply chain can greatly benefit companies by reducing costs, increasing revenue, and speeding up the process of achieving business goals. The impact of supply chain technologies can be seen in both direct and indirect ways, providing benefits that may not be immediately apparent but still advantageous for the company. This applies to both retailers and manufacturers who can reap the rewards of an optimized supply chain.

- IMPROVED ACCESS TO INFORMATION

The success of a supply chain technology depends on its ability to connect previously disconnected data. When different parts of the supply chain, such as people, computer systems, or trading partners, do not communicate information in a regular, dependable, and repeatable manner, it leads to information silos. These silos can occur when internal corporate divisions and operations do not share information, resulting in longer reaction times, faulty execution, and inaccurate forecasts. To address this, supply chain technology is used to capture data and make it accessible to all participants, providing visibility into customer behavior and network-wide information on significant supply chain operations, demands, and disruptions. With advancements in mobile technology, businesses can quickly check inventory status, warehouse activity, and product movement, better meeting client demands. Best-in-class companies have a comprehensive view of their orders, inventory, workforces, transportation networks, warehouses, and partner activity, allowing them to anticipate events more clearly, make better plans, and respond more quickly. With complete and understandable supply chain information, businesses can react quickly to unplanned and potentially disruptive events

- IMPROVED IINSIGHT

Insight is the foundation for making important decisions. Supply chain technology simplifies the process of assessing data, obtaining knowledge on various aspects such as customer demand,

warehouse limitations, and supplier lead times, and making decisions that affect overall supply chain efficiency both directly and indirectly. Moreover, supply chain technology offers decision-making assistance tools that enable faster and more efficient decision-making. Companies can process data and simulate different scenarios in real-time to evaluate multiple options and comprehend the trade-offs associated with each decision, resulting in smarter decisions

- IMPROVED AGILITY

The use of technology in the supply chain can enhance agility by providing better access to information and simulations, allowing executives to quickly solve problems and identify new business opportunities. However, the presence of barriers or silos in organizational processes or systems can impede this agility. It is crucial to monitor the entire supply chain, assess the impact of occurrences, and implement preventative measures. Reliable supply chain technologies can suggest optimal actions that can be adapted as soon as they become available, which is vital in today's fast-paced business environment. Effective providers who can integrate planning and execution can ensure that all members of the organization are informed and working towards the same goals.

- BETTER COLLABORATION

Collaboration is a process where individuals or organizations work together to achieve a common goal. Successful supply chains require technology and systems that enable, monitor, and assess collaboration between individuals, departments, and organizations to ensure a continuous flow of information, analysis, and decision-making. Collaboration is crucial for meeting the demands of omnichannel consumers who expect more choice, speed, and flexibility. Digital enablement is essential for businesses to be agile and responsive to these expectations. In highly competitive industries, maintaining synchronization across a vast network is a defining characteristic of successful supply chains. Manufacturers and retailers who have achieved this level of cooperation consistently perform better on financial metrics such as inventory turnover, cost savings, and service levels

- IMPROVED CUSTOMER LOYALTY

Today's retail landscape, providing a seamless omnichannel experience for customers is crucial for retaining existing customers and attracting new ones. Customers often prefer to check the availability of the products they are interested in before visiting a physical store or placing an online order. Hence, retailers need to ensure timely and complete shipments to their locations, enabling them to fulfil customer demands promptly. This requires efficient supply chain technology that offers visibility, accuracy, and flexibility. By using advanced supply chain technology, retailers can enhance customer loyalty and improve their overall shopping experience. Without it, this would not be feasible.

## **4.2** WEAKNESS

Excessive dependence on technology in supply chain management, while beneficial for speeding up procedures and enhancing productivity, can also become a weakness. This is because any breakdown or malfunction of the technology can disrupt the entire supply chain.

- Cost: Supply chain technology implementation and upkeep can be pricey, especially for small and medium-sized organizations. Aside from that, updates and upgrades could be required to keep up with evolving technologies.
- Security risks: Information and data, on which supply chain technology depends, are susceptible to hacking and cyber-attacks. To protect sensitive data, it's critical to have robust cyber security procedures in place.
- Integration problems: It can be difficult to integrate various supply chain technologies and systems, especially if they are incompatible. Data delays and discrepancies may result from this.
- Human error: Despite technological advancements, supply chain management still faces the risk of human error. Technology can reduce these dangers, but qualified employees who can use the equipment successfully are crucial.

## **4.3** OPPORTUNITIES

- Automation: Robotics and automation technologies can boost accuracy, decrease labour costs, and improve the efficiency of supply chain processes.
- Using predictive analytics, firms can find trends and patterns in their supply chains, allowing them to make better decisions and foresee future disruptions.
- Block chain: Block chain technology can increase trust and accountability by enhancing supply chain transparency and traceability.
- Internet of Things (IoT): IoT devices can be utilized for a variety of purposes, including inventory management, product condition monitoring, and route optimization.
- Artificial intelligence (AI): AI can be used to better decision-making, streamline operations, and analyze vast volumes of data.
- Cloud computing: Cloud computing can improve scalability and flexibility while enabling real-time access to data and collaboration across various supply chain participants.
- Augmented reality (AR) can be utilized to improve training and visualization, making it easier for employees to comprehend challenging tasks and procedures.

## **4.4** THREATS

- Threats to cyber security: The use of technology has increased the susceptibility of supply chains to cyber attacks like hacking, data breaches, and ransom ware. The supply chain's exchange of sensitive data and information could be compromised, resulting in losses in money and reputational harm.

- Issues with data accuracy or completeness may arise through the usage of technology, such as automated data gathering and processing tools. Poor decision-making could result from this, which would affect the supply chain's overall effectiveness.
- Complexity: Using cutting-edge technology like artificial intelligence and machine learning may make the supply chain more complex. The management of the supply chain could become more difficult as a result.
- Dependence on technology: A single point of failure brought on by an excessive dependence on technology could expose the entire supply chain. The supply chain could be severely disrupted by technical issues or system failures, resulting in delays and financial losses.
- Costs of implementation: Organizations may incur large expenses as a result of implementing new technology. This might include the price of buying, setting up, and instructing staff members on how to use new technology.
- Transparency in the supply chain: The use of technology may improve supply chain transparency. However, since suppliers could be hesitant to reveal sensitive information, this could also create difficulties in maintaining supplier relationships.

# CHAPTER 5

# FINDINGS, SUGGESSION AND CONCLUSION

## 5.1 FINDINGS

- Recent advancements in digital systems and tools, including big data analytics, cloud computing, blockchain, and the internet of things (IoT), have led to a significant technological transformation in supply chain management. These technologies have resulted in increased efficiency, visibility, and collaboration across various stages, including procurement, production, transportation, and distribution.
- One of the major benefits of these technological advancements is the ability to track products throughout the entire supply chain, from the manufacturer to the final consumer. This has led to improved supply chain visibility, reduced waste and losses, and better inventory management.
- Collaboration and communication among supply chain partners have also been enhanced, leading to improved coordination and reduced lead times. With the use of data analytics, companies can now identify inefficiencies and areas for improvement, optimize supply chain operations, and make data-driven decisions.
- Automation, such as robotics and artificial intelligence (AI), has led to improved efficiency and reduced costs at various stages of the supply chain. In addition, the adoption of blockchain technology has made it possible to track transactions in a safe and transparent manner, thereby improving supply chain security and reducing the likelihood of fraud.
- Certain digital technologies are more commonly used in certain areas of the supply chain. For example, AI might be used more heavily in inventory management and demand forecasting, while blockchain might be used more in logistics and shipping.
- The integration of technology in supply chain management has led to a revolution, making it more effective, transparent, and adaptable, resulting in increased customer satisfaction and firm profitability

## 5.2 SUGGESTIONS

- Prioritize digital technology adoption based on supply chain functions and organizational goals.
- Develop a roadmap for digital technology implementation, considering factors such as costs, feasibility, scalability, and potential impacts on existing processes and systems.
- Ensure data security and privacy through robust cybersecurity measures and compliance with relevant regulations.
- Invest in training and development programs to build the necessary skills and capabilities for managing digital technologies in the supply chain.
- Foster collaboration and communication among supply chain stakeholders to ensure interoperability and seamless data exchange.
- Continuously monitor and evaluate the performance of digital technologies in the supply chain, and make necessary adjustments to optimize their usage.
- Stay updated with emerging trends and advancements in digital technologies to identify new opportunities for supply chain optimization.

- Collaborate with technology partners, vendors, and industry experts to leverage their expertise and insights in implementing digital technologies in the supply chain.
- Share best practices and lessons learned within the organization and with industry peers to foster continuous learning and improvement.
- Consider the ethical implications of digital technologies, such as the impact on employment, social equity, and environmental sustainability, in the supply chain.

## 5.3 CONCLUSION

The digitalization of the supply chain has emerged as a transformative trend in the field of logistics and operations management. The adoption of digital technologies has enabled organizations to streamline their supply chain operations, enhance visibility, improve efficiency, and gain a competitive edge in the global marketplace. The benefits of digitalization in the supply chain are evident across various aspects, including procurement, production, transportation, warehousing, inventory management, demand forecasting, and customer service. By leveraging technologies such as big data analytics, Internet of Things (IoT) devices, artificial intelligence (AI), blockchain, and cloud computing, organizations can capture, analyze, and utilize vast amounts of data in real-time, resulting in improved decision-making, reduced lead times, increased agility, and optimized resource allocation. Moreover, the use of digital technologies has also facilitated collaboration and information sharing among supply chain stakeholders, including suppliers, manufacturers, distributors, logistics providers, and customers. Real-time communication, data sharing, and visibility into each step of the supply chain have enhanced coordination, reduced delays, minimized errors, and mitigated risks, leading to improved customer satisfaction and loyalty.

However, the digitalization of the supply chain also comes with challenges, including concerns related to data security, privacy, interoperability, and change management. Organizations need to invest in robust cybersecurity measures, data governance frameworks, and interoperable systems to ensure the integrity, confidentiality, and availability of data across the supply chain. Additionally, change management efforts are required to address the cultural, organizational, and process changes associated with digitalization, including upskilling the workforce, redefining job roles, and redesigning business processes. In conclusion, the digitalization of the supply chain is a game-changer for organizations looking to gain a competitive advantage in the dynamic business landscape. It offers unprecedented opportunities to optimize operations, enhance visibility, improve decision-making, and deliver superior customer experiences. However, organizations need to carefully navigate the challenges and invest in the right technologies, processes, and people to fully realize the benefits of digitalization in the supply chain. Those who successfully embrace digitalization are likely to be at the forefront of supply chain excellence and poised for sustainable success in the future.

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