RECENT ADVANCES IN SUPPLY CHAIN MANAGEMENT

Dr. Deepak Chauhan
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CHAPTER 1

CONCEPT OF SUPPLY CHAIN MANAGEMENT SYSTEM

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Abstract: Supply chain management is crucial since it may aid in achieving a number of corporate goals. Controlling production procedures, for example, may enhance product quality while lowering the likelihood of recalls and legal action and assisting in the development of a powerful consumer brand. Controls over shipping processes may also enhance customer service by preventing expensive shortages or times of inventory overproduction. Overall, supply chain management gives businesses a number of chances to increase their profit margins, and it is particularly crucial for big, global businesses. In the chapter discussed about the supply chain management's importance, Benefits of Supply Chain Management, Key Elements of Effective Supply Chain Management**.**

Keywords: Business,Logistics, Operation, Product, Supply Chain Management

Introduction

Supply chain management is the control of the movement of products and services, encompassing all processes that turn raw materials into completed items (SCM). This can involve the transportation and storage of raw materials, inventory for work-in-progress and finished items, as well as the entire order fulfilment procedure from the point of origin to the place of consumption. The products and services that end consumers in a supply chain require are provided via networks, channels, and node companies that are interconnected, interlinked, or linked together. The term "design, planning, execution, control, and monitoring of supply chain activities with the goal of generating net value, building a competitive infrastructure, leveraging global logistics, synchronizing supply with demand, and measuring performance globally" refers to the activities that are performed along the supply chain. SCM practice, which strives for an integrated, multidisciplinary, and multimethod approach, notably incorporates industrial engineering, operations management, systems engineering, logistics, buying, information technology, and marketing. Marketing channels are heavily used in the supply chain management process. One of the main concepts in SCM is supply chain resilience. SCM's "people component," ethical considerations, and internal integration, according to some.

Important is supply chain management:

Systems for effective supply chain management save costs, waste, and production cycle times. The industry norm now is a just-in-time supply chain, whereby retail sales instantly convey replenishment orders to manufacturers. After that, store shelves may be restocked very immediately after goods are sold. One method to further enhance this process is to analyses the data from supply chain partners to identify where further adjustments can be made. Effective supply chain management increases the value of the supply chain cycle:

Recognizing possible problems: If a customer orders more goods than a company can provide, they may complain of bad service. Through data analysis, manufacturers might be able to predict the deficiency before the client expresses dissatisfaction.

Dynamic pricing optimization: Seasonal goods have a limited shelf life. Near the end of the season, these items are frequently discounted or thrown out. Airlines, hotels, and other companies routinely dynamically modify prices to meet consumer demand for perishable "products". By using analytical tools, similar forecasting techniques can raise margins even for difficult goods.Increasing the dispersion of the inventory that may be delivered: With the use of analytical software tools, activities and resource allocation may be dynamically scheduled in accordance with sales projections, current orders, and promised delivery of raw materials. When an order is placed, manufacturers may promise a product delivery date, which reduces the number of unfulfilled orders [1].

Key features of efficient supply chain management:

The more efficient and effective supply chain management, the more it will protect a company's reputation and long-term existence.

Connected: Having access to conventional data sets made accessible by conventional ERP and B2B integration technology as well as organized and unstructured data from the Internet of Things and social media (IoT).

Collaborative: As multi-enterprise cooperation and engagement become more important, cloud-based commerce networks are being used to improve collaboration with suppliers.

Cyber-aware: The supply chain should be preoccupied with safeguarding and hardening its systems against hackers and online intrusions.

Cognitively enabled: The AI platform becomes the command center of the contemporary supply chain by compiling, organizing, and directing decisions and activities across the chain. The vast bulk of the supply chain is automated and self-learning.

Detailed: Analytics must grow in real time with the information. The revelations will come swiftly and completely. Future supply chains will not be able to tolerate delay.

Many supply chains have already begun the process as interest in cloud-based commerce networks is at an all-time high and considerable efforts are being made to increase analytics capabilities.

Benefits of Supply Chain Management

Lower Prices: By utilizing technology and merging suppliers, businesses may save operational costs while improving their ability to serve customers. Managing based on demand, for instance, stops companies from overproducing, which decreases costs for labor and raw resources as well as inventory control and transportation.

Increased Revenue: Businesses that utilize technology to stay more in touch with client demand and respond quicker boost the probability that a product will still be available for purchase by customers. Labor and resources may be employed to develop new goods to offer customers and diversify the product range when manufacturing is simplified to produce only what is required. This may mean offering clients extra services that are unrelated to merchandise.

Utilizing Resources: Organizations can use capital assets, such as production or transportation equipment, most efficiently with good supply chain management. Businesses can manufacture as needed, avoiding the needless wear and tear on manufacturing equipment. Supply chain management helps companies to handle returns with simplicity, assure product availability, reduce quality issues, and deliver things more quickly, thus creating value for both the company and its customers.

Literature Review

Rehman Khan [2] Supply chain management overview. SCM is the process of integrating interactions with business partners, starting with the raw material supplier and ending with the ultimate client or consumer. This process includes all transportation, intermediate processing, storage, and, at the very end, sales to these parties. The SC practices are playing a critical role in today's competitive corporate climate in terms of lowering total company costs, eliminating waste, raising the quality of goods and services, and, ultimately, creating competitive advantage. Many businesses have been aware of the advantages of supply chains since the 1980s. Manufacturing, storage, purchasing, and supply chain participants are the building blocks of SC. Finally, SCM practice evolves as a result of changes in technology, political pressures, economic circumstances, and market position throughout the globe. These are the main supply chain leading indicators, to put it simply.

Waters D [3] Introducing supply chain management via logistics It explains the flow of materials from suppliers into an organization, via organizational processes, and out to clients. As you can see, we approach logistics from a wide perspective, including every kind of organization and material being moved. Manufacturers of physical items and service providers of intangible services both move materials. Every organization requires a steady supply of supplies. Managers must ensure that the transfer of commodities is as efficient and effective as possible since logistics is a crucial role. The best way to do this is via an integrated function that is in charge of all facets of material flow. Results are significant because they have a direct impact on expenses, customer service, and just about every other performance metric. Although it is not a part of an organization, logistics plays a special role in connecting customers and external suppliers. A supply chain's goal is to please consumers, and organizations are increasingly aware that they do not operate in a vacuum. Some individuals prefer to use the term supply chain management to emphasize this role's larger scope. This industry moves very quickly. The demands on logistics are evolving quickly as a result of developments in operations including just-in-time, lean operations, effective customer response, enterprise resource planning, e-commerce, globalization, and improving customer service. This book provides a modern perspective on logistics, focusing on recent trends and advancements. It addresses significant themes including the growing strategic significance of logistics for global operations and the escalating level of international competitiveness. Organizations and activities in the supply chain are integrated logistical needs are shifting to accommodate new kinds of activities improved communication enabling for more precise movement coordination new needs resulting from e-commerce elements Environmental issues are being given more attention, along with quality and customer-based service.

Waters D [4] discussed the technologies for supply chain management introduction. The idea and practical implementation of supply chain management (SCM) cannot be imagined without reference to the enabling capabilities of modern information technology. The second edition of

Introduction to Supply Chain Management Technologies elaborates on the software toolkits and suites driving integration in the fields of customer management, production, procurement, warehousing, and logistics, building on the principles of the previous edition. The author offers fresh perspectives on the constantly developing subject of SCM by examining the innovations brought about by the appearance of new Internet-based technologies in information, channel, customer, production, sourcing, and logistics management.

Scott C *et al*. [5] discussed about supply chain management technologies . You are guided through the fundamentals of supply chain management in this. It starts out by introducing you to a supply chain with straightforward product, information, and money transfers. Second, it provides a functional perspective on supply chain management and introduces the framework of the subsequent five chapters, which cover plan, source, manufacture, deliver, and return. The dynamics and architecture of the supply chain will be examined third. You will learn about the difficulty of balancing supply and demand with inventories in this section. An overview of the following 10 supply chain management chapters follows the chapter's conclusion. With this chapter under your belt, you can: Define supply chains and list the key elements that make them up. Define a suggested functional model for classifying supply chain operations. Analyze the design and behavior of product supply networks.

Latour Bruno [6] Predicting the way flexible polypeptides bind to proteins is a crucial challenge that is beyond the scope of most small molecule and protein–protein docking technologies' applicability. Here, we evaluate the small molecule flexible ligand docking tool Glide on a collection of 19 non-helical peptides and systematically raise Glide sampling for flexible polypeptides to increase the accuracy of posture prediction. Additionally, scoring of the postures was enhanced by post-processing using implicit solvent MM-GBSA calculations based on physics. The success rate (RMSD 2.0 for the interface backbone atoms) increased from 21% with default Glide SP settings to 58% with the enhanced peptide sampling and scoring protocol in the case of redocking to the native protein structure. This success rate was measured using the best RMSD among the top 10 scoring poses. This is almost 100 times quicker than and nearly as accurate as the newly released Rosetta FlexPepDock technique. 40% of peptides were successfully docked via cross-docking in the subset of situations when an unbound receptor structure was provided. Our analysis of the data reveals that the improved polypeptide technique is most accurate for prolonged peptides with a small size and few formal charges, establishing a range of situations in which it may be used.

C. L. Martins and M. V. Pato [7] One of the most active and active decision management research areas in the past 30 years is supply chain sustainability. With the introduction of new modelling and theoretical frameworks, developing subjects, and trans disciplinary viewpoints, the number of primary and secondary research publications keeps rising annually. Motivated by this body of literature, the objective of this research is to assist the systematic evaluation of 198 surveys published between 1995 and 2018 by reviewing important supply chain management principles, sustainability viewpoints, and methodological elements of literature reviews. The goal is to provide answers to three research questions: which literature evaluations on supply chain sustainability are now available; what are their methodological characteristics; and what are their key goals and topic areas. The research maps and evaluates the source material in accordance with analytical categories related to methodological and content aspects after performing a content analysis. The research demonstrates that systematic literature reviews are becoming as the de facto approach for doing evaluations of the literature on sustainable supply chains. The

systematic technique demands methodological rigour, which reviews often fail to satisfy and report. Social components continue to be neglected, particularly when compared to the environmental factor, despite the fact that the majority of the assessments that were found embrace a triple bottom line approach on sustainability. This graduate-level study provides a thorough, critical overview of the state of supply chain sustainability research today.

James R. Stock *et al*[8] Supply chain management (SCM), which first appeared as a concept in the 1980s, has seen tremendous development. Three key themes related to the supply chain and SCM were found via a qualitative study of 166 different definitions of SCM that were published in the literature: (1) activities; (2) advantages; and (3) constituents/components. These topics are used to identify important study questions and problems in the supply chain and SCM that marketing academics may look into. 2009.

DISCUSSION

Challenges of Supply Chain Management: From Amazon's Prime Air drones that will fly packages directly to your doorstep in 30 minutes to the over $1.5 trillion in US trade with Asian markets in 2015, the world has become increasingly complex, and managing the operations of a supply chain around the world has been facing increasingly complex challenges. In March 2016, the Google Alpha Go program claimed the final game for a sweeping 4-1 series victory over the top South Korean Go grandmaster Lee Sedol. Changing from an outdated purchasing order handling process to a new enterprise resource planning (ERP)/SAP system to streamline information flow along the supply chain process, moving manufacturing facilities from multiple offshore locations to near shore regions like Mexico1 to shorten order lead times and respond more quickly to market dynamics, and expanding North American sales are some examples of these challenges to a company's strategic moves. The execution of such strategic changes presents even more difficulties, including those included in market demand forecasting, demand-supply planning, inventory placement, managing relocation projects, shipping and warehousing, and completing client orders and providing customer support.

We must take into account a number of key factors that have an impact on network performance in order to make choices that will maximize supply chain productivity, including demand forecasting, demand-supply planning, inventory management, project management, and service management. The capacity to predict demand properly is one of the key factors in supply chain management. Simply said, if we can better predict demand, we will be able to plan and manage the supply chain more effectively. Accurate predictions of customer demand in the present and the future are necessary for all supply chain decisions, including inventory, production, scheduling, facility location and design, workforce planning, outsourcing contract development and negotiation, and distribution and marketing strategies. Since we cannot predict the future, forecasting is never certain. However, by using a combination of qualitative techniques, based on expert opinion and past experience, and quantitative techniques, based on rigorous mathematical theory, as well as adequate measures of forecast accuracy and adaptable procedures, we are able to create accurate estimates of demand that serve as input for subsequent supply chain decisions. The arithmetic mean, last period value, moving averages, and exponential smoothing are examples of techniques for stationary behavior, while linear regression and Holt's method are examples of techniques for trends, and seasonal indices and winter’s method are examples of techniques for seasonal behavior. We also go over the benefits of collaborative planning, forecasting, and replenishment (CPFR), which allows trading partners along the supply chain to

share information in order to improve forecasting accuracy. As a result, inventory and upcoming needs can be updated continuously, improving the efficiency of the entire supply chain process. As with includes case studies that illustrate the decision-making process as well as activities that show how to use the strategies covered.

One of the biggest problems for every supply chain management team is balancing supply and demand. Planning for demand and supply is a business procedure. This business process seeks to allocate supplies in the most cost-effective way possible while taking into account a variety of practical constraints, given a planning horizon, confirmed customer orders to be fulfilled or accurate forecasts of expected demand, as well as the supplies needed to address market dynamics brought on by promotion sales and competitor actions. Examples of such restrictions include the capacity for production and logistics, the availability of suppliers, shipping and storage bottlenecks, shifting business objectives, and customer requirements. Supply chains have always faced significant challenges with effective demand-supply planning; even businesses that have fully implemented contemporary ERP systems, like Oracle and SAP, may experience supply chain failures and experience the demands of crisis management due to a lack of such strategies. Effective demand-supply planning, which evolved from conventional aggregate planning, aids in integrating and optimizing the processes for supplying raw materials, manufacturing operations, the demands placed on human resources, inventory management, and distribution pro-cases over the course of the planning horizon. Linear programming is a crucial decision support tool and mathematical optimization method that has been extensively utilized to direct better demand-supply planning of supply chains across industries (LP). There are several real-world demand-supply planning issues that may be explained in terms of LP models. Although there are numerous effective computer-based LP solvers, including Gurobi2 and IBMILOG CPLEX Optimization Sales and Operations Planning, will be on the mathematical modelling of LP problems, their solution using the Microsoft Excel Solver Add-in, and on developing suitable business processes.

Supply chain management depends on determining the best inventory policy, or how much and how often to order the necessary goods and supplies. While ideally shipments arrive precisely when and where they are needed at the desired quality level, we often need to employ stored inventory to balance supply with demand. This is because inventories are frequently retained as buffers in the supply chain network. We provide the elements and presumptions required for different inventory models and discuss the trade-off between economies of scale vs. inventory holding costs in managing inventory and figuring out the best inventory strategy. For situations where demand must be met as it arises, as well as those where we may consider the more flexible alternative of planned shortages, or backorders, and those where a quantity discount may be offered, these models include the economic order quantity (EOQ) Model. It is appropriate for long life cycle products with known constant demand. We show how to determine and assess the relative advantage of a mixed SKU strategy in situations where multiple stock-keeping units (SKUs) are carried. Joint ordering strategies provide a cost-effective operating policy by reducing fixed ordering costs, but at the potential cost of sub-optimal ordering cycles. In most actual supply networks, the demand is unclear. Short life cycle products are ones that cannot be replenished throughout the selling season. Perishable goods or seasonal things like Christmas trees, Thanksgiving turkeys, Valentine's Day flowers, and clothing would be examples of this. When items are bought from low-cost manufacturing nations, shipping problems may lead to lengthy lead times, making replenishment throughout the season impossible. When deciding on

order amounts and managing inventory in such circumstances, the Newsvendor Model tackles the trade-off between missed revenues and markdown expenses. Durable goods, which make up the bulk of retail products and commodities used in international commerce, can have lengthy life cycles, extended shelf lives, and lengthy lead times from the time an order is made and when it is delivered. When actual demand exceeds the quantity predicted and planned for, or when uncertainty in suppliers' inventory availability leads in a mismatch between supply and demand, we may employ safety stock as a buffer against forecasting mistakes. We take into account a variety of mathematical models that balance service needs with safety stock costs while assuming demand unpredictability.

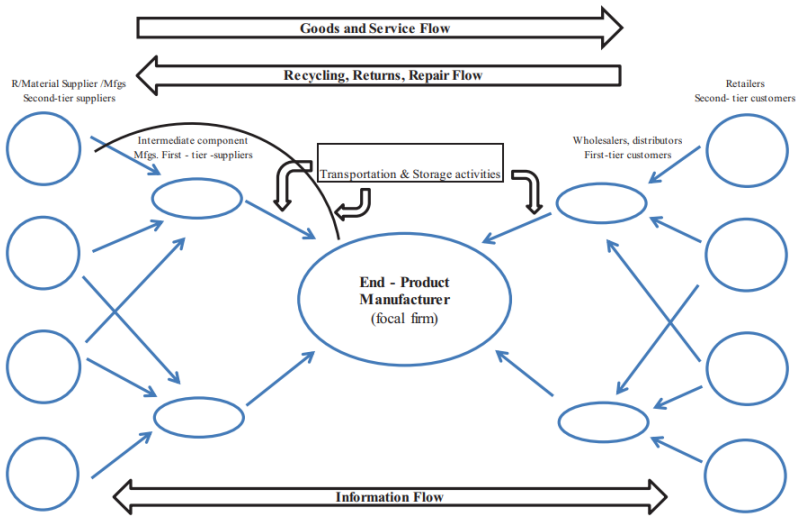

Figure 1: A generic view of supply chain

Figure 1 depicts a broad view of the supply chain. Companies remove raw resources like iron and wood from the earth and then sell them to providers of raw materials, such lumber mills or steel mills. Purchase Orders (POs) and requirements from component manufacturers are followed by these firms, and the manufacturers then turn raw materials into products that these clients may utilise (such as lumber and sheet steel). Then, component manufacturers develop and sell intermediate items in response to the orders from their clients (the producers of completed goods).

The manufacturers of finished goods (companies like General Motors and Coca-Cola) assemble the intermediate items they have acquired and sell the finished goods to wholesalers or distributors, who then resell the goods to retailers in accordance with the orders they receive. Finally, merchants offer such things for sale to ultimate customers. Customers purchase goods and services from businesses based on certain requirements.

Every single customer has their own needs and standards. But typically, people base their purchases on the following factors: Product quality; Price, Product selection, Accessibility, Post-purchase support Companies that successfully meet the needs and wishes of their customers are able to dominate their respective markets. Because of this, a lot of businesses now provide a single product in a variety of SKUs (stock keeping units), allowing them to offer a wide range of items and ensure availability, among other things. Customers often need to return items as a result of manufacturing flaws, warranty repairs, or recycling along the whole supply chain.

The term "supply chain" refers to the network of businesses that ultimately produce and make services and products available to customers, as well as all the activities that make possible the acquisition, production, storage and delivery, return or recycling of materials, final products, and services. To meet the demands and wants of clients, many businesses nowadays have several supply chains for their various goods. Modern supply chains are designed to "make the consumer pleased, not just satisfied." In contrast to old supply networks, which consisted of a small number of suppliers, merchants, and manufacturers that produced a narrow variety of goods, modern supply chains are more complicated. Today's manufacturers, however, produce a variety of goods, and each product's supply chain involves a number of suppliers, distributors/wholesalers, and retailers.

End users, often known as customers, are the sole source of revenue for firms that manage the whole end-to-end supply chain. Companies must create efficient SCM processes while keeping the consumer in mind, according to Steve Dare dinger, vice president of Cisco Systems of California. When one firm disregards the needs of other supply chain participants or end clients/consumers, increased levels of risk and expense are eventually transferred throughout the supply chain. For instance, generally speaking, greater end product costs will result in poorer customer service standards or maybe less end-user demand.

CONCLUSION

Coordination of the many tasks required to create and deliver products and services to clients is known as supply chain management. Designing, farming, manufacturing, packing, and shipping are a few examples of supply chain operations. The objective of supply chain management is value creation, and a company creates value by providing goods or services to its customers by managing the delivery of a product from raw materials to the consumer, the management of resources (such as information, assets, and products), and the management of capabilities (such as the people who work within the supply chain). These capabilities should be sustainable (where there is embedded value for customers), energy efficient (due to corporate social responsibility), and PR-friendly

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CHAPTER 2

SUPPLY CHAIN MANAGEMENT CONCEPTS

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Abstract:

A supply chain is the network of all the people, businesses, resources, tasks, and technological advancements involved in the production and distribution of a good. A whole supply chain, from the distribution of raw materials from the supplier to the producer to the final delivery to the customer, is included. In this chapter discuss about the benefits, supply chain management drawbacks, and types of supply chain models.

Keywords:
Business, Distribution, Network, Supply Chain, Value.

INTRODUCTION

Supply Chain Management requires a number of crucial tasks to be accomplished in a timely way while efficiently conserving resources like gasoline and money. Otherwise, buyers won't be able to purchase the product when they need it. It was noted that this propensity was a big area for future improvements in efficiency because the system was so disjointed in the 1960s. Improved job integration has allowed supply chain management to advance. Although the majority of the logistical operations have remained constant, they were first split into two distinct responsibilities related to physical distribution and materials management. A single management perspective was connected with the whole supply chain[1], [2]. A more extensive integration was only possible with information and communications technology, however, as supply chain management advanced. By enabling the integrated management and control of data, financial, and commodity flows, this opens the door to a new range of production and distribution systems. Supply chain management has evolved into a challenging set of responsibilities intended to increase competitiveness and value. More recently, the increasing degree of automation in supply chains has had a considerable impact on the development of physical distributing and materials management. This digitalization is most noticeable in distribution centers where areas like storage, materials handling, and packaging have seen a considerable push toward automation. Automated delivery cars may one day be available.

Advantages:

Efficiency of Cost: Supply chain management assists the business in becoming cost-effective. In order to reduce expenses related to production, packaging, storage, and shipping, it works to simplify every business activity. Additionally, it permits punctual delivery to avoid product waste. Overall operating expenses are reduced, and overall profitability is increased.

Improve Output: Increasing overall corporate productivity is the aim of supply chain management. Supply managers monitor each stage of production to ensure that every resource is being used efficiently. Resource waste may be minimized so that overall productivity is maximized.

Avoids Process Delay: The fact that supplier change management doesn't cause any delays in company processes is one of its primary advantages. To support continuous product manufacturing, the supply chain manager ensures that all materials are acquired on time. They also oversee all logistics and distribution services utilised by firms, encouraging delivery at the appropriate time and location and avoiding delays.

Identify Problem Areas Quickly: Supply chain management assists companies in discovering the issues that are harming their reputation and financial performance. Managers may easily assess each department's performance to see if it is doing its job in an insufficient manner. Without this concept, it would be difficult to pinpoint the issue, and all departments will begin shaming one another for any problems that occur.

Improved Interaction: The communication between many corporate stakeholders is improved via supply chain management. It focuses on developing an effective communication pathway inside the business to avoid any misunderstandings or disputes. Effective communication among all stakeholders, including staff, customers, suppliers, and distributors, develops improved comprehension and collaboration.

Supply Chain Management Drawback:

Expensive to Adopt: The supply chain management method has a big disadvantage in that it is expensive to adopt. Small businesses cannot afford it since it requires a substantial time, financial, and other resource commitment.

Complicated: Because it incorporates several organizational departments, the supply chain management process is highly complicated. It can cause confusion and harm regular business operations. Employees may be unwilling and demotivated to accept this concept as it is unknown to them, which might result in a variety of additional problems.

Ineffective Departmental Coordination: The supply chain management approach will only be successful with enhanced Departmental Coordination. When it comes to encouraging collaboration among several departments in a major organization, this notion can eventually fall short.

Requires Personalized and Trained Staff: To execute supply chain management inside a firm efficiently, qualified and trained human resources are required. The expense of employing such a polished and highly qualified workforce will be significant for the business. Its implementation for small firms could not be advantageous.

Lack of Dependability: Supply chain management lacks dependability since it depends only on the information sharing between departments. Erroneous information shared by any department will have a detrimental effect on the efficiency of the whole supply chain.

Supply Chain Model Types: Depending on the firm, supply chain management is applied in different ways. The SCM method used by each company is distinct because of its own goals, constraints, and benefits. Six basic models may often be used by corporations to guide their supply chain management processes.

Continuous Flow Model: This supply chain technique, which is more common, works best for established industries. The continuous flow model assumes that a producer will consistently produce the same good and that customer demand will be relatively stable.

Agile Strategy: This model is best for businesses that sell things that customers order. This approach places an emphasis on adaptability because a business may have a particular requirement at any given time and must be ready to change course accordingly.

Fast Model: This model places an emphasis on a product's rapid turnover due to its brief life cycle. A corporation uses the rapid chain model to try to take advantage of a trend, produce products quickly, and make sure the product is completely sold before the trend ends.

Flexible Model: Businesses impacted by seasonality benefit most from the flexible model. During the busiest times of the year, certain businesses may have very high demand requirements and very low volume requirements. A flexible supply chain management strategy ensures that production may be quickly increased or decreased.

Efficient Model: Businesses that compete in sectors with extremely constrained profit margins may try to gain an edge by optimizing their supply chain management procedures. This entails making the best use of gear and equipment, as well as effectively managing inventories and processing orders.

Custom Model: A corporation can always turn to a custom model if one of the aforementioned models doesn't work for its requirements. For highly specialized sectors with demanding technical standards, like an automobile factory, this is frequently the case.

LITERATURE REVIEW

Kamola A. Mukhamedjanova [3] The purpose of the research is to provide a scientist's perspective on the theoretical underpinnings of supply chain management. The concept's development was divided into three major stages: the 80s saw the concept's formulation and the idea of coordinating the actions of companies within the chain; the 90s saw the integration of key business functions, the idea of focusing on end-customer needs and other types of competition - between chains, rather than between individual firms; and the final separation of the concept of logistics from SCM; the supply chain management concept. The work of writers who examined the idea of supply chain management from a philosophical, scientific, and procedural standpoint was attempted to be analysed. The primary points of view and opinions are related to the process approach, it was determined in the end.

Kamola A. and Mukhamedjanova [4] Over the last several years, supply chain management has acquired a crucial role in business success and received substantial study attention. An effort has been made in this work to review the supply chain management literature. An examination of the literature suggests a considerable upsurge in SCM theory and practice research. A review of the literature for 29 studies published between 2005 and 2011 is offered here. This study's objective was to provide an up-to-date, succinct overview of the SCM literature that concentrated on the SCM concept's core ideas.

Shivam Gupta *et al.* [5] The literature review of several research papers serves as the foundation for the research paper's discussion of supply chain management ideas. The research study also seeks to clarify the significance of effective supply chain management for the firms to match consumers' expectations by giving them high-quality goods & services. Effective SCM techniques aid businesses in gaining a competitive edge over rivals, which in turn fosters customer satisfaction as consumers get the goods and services that meet their expectations. As a result, an organization's performance also improves, and its profit margins could even increase.

Sylwia Konecka [6] Lean and agile supply chain managements are common and extensively covered in literature, as well as their hybrid variants (league supply chains). To differentiate these styles of management from techniques and instruments like outsourcing, single sourcing, rapid response, standardizing principles, and postponement, there are some disagreements, nevertheless. The notions stated above are seen favorably as methods for enhancing supply networks' competitiveness. A newly coined word, SCRM (Supply Chain Risk Management), highlights the significance of risk management in supply chains as a result of the potential of such networks to obtain a competitive advantage via the identification, estimation, management, and control of risks. As a result, it appears advantageous to consider the connections and dependencies between these notions (some references to the author's own study were made). The articles spend a significant amount of time on how to identify hazards associated with the supply chain management tools outlined above. However, because to the basic factors that affect how a supply chain operates, such as the nature of the demand, the characteristics of the items, and the overall lead time, the notions of lean and agile management are often debated. The author claims that supply chain risk management might be seen in relation to the topics stated. It could make it

easier to choose a supply chain strategy based on the risk assessment. A number of case examples were added to substantiate the considerations that were made.

Mihai Felea & Irina Albăstroiu [7] By looking at some of the most popular Supply Chain Management concepts, frameworks, and terminology, this study aims to present an expanded approach to supply chain management. It should be noted that the methodology of our study was based on content analysis of the most significant and well-known definitions of supply chain management and related terms, using a variety of secondary sources, including scientific papers and publications from practitioners and professional organisations. In our project, we investigated and analysed the definitions of the aforementioned concepts in order to establish conceptual boundaries that would clarify the scope of the supply chain management concept in the eyes of both theorists and practitioners. We also sought to identify the criteria and attributes that have been defined over time by academics and business representatives in order to suggest new definitions for the concept. Additionally, we considered how the phrase "Supply Chain Management" from the English language was accepted and adapted to the Romanian language using Romanian literature as a guide. This helped us to determine the right technique of transposing and describing the idea in the Romanian literature.

Van der Vorst *et al.* [8] Predicting the way flexible polypeptides bind to proteins is a crucial challenge that is beyond the scope of most small molecule and protein–protein docking technologies' applicability. Here, we evaluate the small molecule flexible ligand docking tool Glide on a collection of 19 non-helical peptides and systematically raise Glide sampling for flexible polypeptides to increase the accuracy of posture prediction. Additionally, scoring of the postures was enhanced by post-processing using implicit solvent MM-GBSA calculations based on physics. The success rate (RMSD 2.0 for the interface backbone atoms) increased from 21% with default Glide SP settings to 58% with the enhanced peptide sampling and scoring protocol in the case of redocking to the native protein structure. This success rate was measured using the best RMSD among the top 10 scoring poses. This is almost 100 times quicker than and nearly as accurate as the newly released Rosetta FlexPepDock technique (63% success for these 19 peptides). 40% of peptides were successfully docked via cross-docking in the subset of situations when an unbound receptor structure was provided. Our analysis of the data reveals that the improved polypeptide technique is most accurate for prolonged peptides with a small size and few formal charges, establishing a range of situations in which it may be used.

A. Aviasti *et al.* [9] The refinement of citronella oil makes a significant contribution to the local economy. The community often serves as a source, producer, and distributor in the supply chain for citronella oil. The supply chain's unpredictability is the biggest issue facing the industry that refines citronella oil. The supply chain for fragrant lemongrass is mapped to ascertain the capabilities and requirements of all parties, from the origins of the raw materials to the retail customers. As a result, refineries are able to produce more due to the ongoing availability of fragrant lemongrass, and market potential may be more accurately predicted. On the other side, industry integration is necessary to mitigate the effects of environmental harm while boosting revenues. The citronella refining industry's symbiosis model aims to maximize both potential and available resources via an effective, integrated, simple-to-implement industrial system. This

essay will go through how the symbiotic relationship between the citronella refining sector and supply chain management ideas may be used to achieve the goals of collaboration in an environmentally friendly supply chain.Kamola A. Mukhamedjanova [10] The purpose of the research is to provide a scientist's perspective on the theoretical underpinnings of supply chain management. The concept's development was divided into three major stages: the 80s saw the concept's formulation and the idea of coordinating the actions of businesses within the chain; the 90s saw the idea of integrating key business functions, the idea of focusing on end-customer needs rather than those of individual companies, and the final separation of the concept of logistics from SCM; and the present day saw the concept of supply chain management emerge. The work of writers who examined the idea of supply chain management from a philosophical, scientific, and procedural standpoint was attempted to be analyzed. The primary points of view and opinions are related to the process approach, it was determined in the end.

DISCUSSION

At the end of the 20th century, a new logistic concept called supply chain management emerged as a result of the growth of logistics theory and practice. Over the last several decades, this idea has been one of the most rapidly rising fields of economic research and industry. The expansion of supply chain management has three objective foundations: the expanding role of the customer, market globalization, and societal information technology. It has since attracted a lot of attention. A supply chain is defined as a group of three or more entities (organizations or persons) actively participating in the upstream and downstream flows of goods, services, money, and/or information from a to a consumer, (and return), according to the majority of current research. The growth of SCM has been influenced by a number of disciplines, including buying and supply, logistics and transportation, operations management, marketing, organizational theory, management information systems, and strategic management. Four conditional stages may be identified in the development of strategic management as it imitates the methods used by the most successful businesses in the top industries. The planning and formulation of marketing and logistics are the major concepts of effective strategies in the first half of the 1970s, at the pre-analytic stage of theory development. The 1980s saw the emergence of scientific disciplines, and positioning emerged as the key idea behind effective tactics. The resource idea dominated the field of effective methods in the late 1980s and early 1990s when it came to self-development. Beginning in the early 2000s, a dynamic theory of strategic management emerged, and the idea of dynamic abilities, strengthening networks, and other types of intercompany coordination became the main idea of effective strategies. Presumably, a fundamentally different approach will be used to the development of the supply chain management concept. The development of a system for coordinating businesses within the chain, as well as the integration of key business processes, have received the attention of researchers and practitioners up to this point. This has led some to suggest that leadership can only be achieved by utilizing one of the fundamental strategies. The terms "value chain" and "value system" are crucial to understanding the idea of "supply chain management," which describes how businesses configure and connect their own internal processes with those of their suppliers, channels, and customers to create the necessary level of value for the consumer.

Supply chains (SCs) are very dynamic as a result of the present economic climate and globalization, making it difficult to plan, organize, and interact with the SC. A change in focus between business level and SC level is necessary because to the expanding environmental and social challenges, and even corporate aims must be linked with sustainability targets. All stakeholders in the SC must cooperate in order to achieve the sustainable objectives. Companies are unable to follow environmental regulations until such a legislation has been put in place. The cost of sustainable initiatives varies from organization to organization. Sustainable projects cannot be seen from a life-cycle perspective without the SC management role, which is one of the key SC roles that considerably contributes to sustainability. Determine and have an influence on activities impacting the planning, control, development of processes, operational framework, and knowledge and communication structure in institutional components in the Supply Chain Management (SCM) literature. However, the components of SC activities such as management techniques, direction, risk management, rewards and appreciation, tradition, role, religion, and interaction are harder to identify and hence more difficult to synchronize. The concepts of sustainability have emerged as one of the primary themes in SCM in the most current literature that is accessible. The triple bottom line approach to SCM policy is evaluated in the current study of the literature.

Sustainable Supply Chain Management has been the focus of several research articles in both qualitative and quantitative disciplines (SSCM). Due to recent global developments, industry changes, uncertainty surrounding demand, and financial challenges, sustainable enterprises are under enormous pressure to be able to maintain the existing SC. The SC's primary tasks, including as procurement, processing, distribution, packing, transportation, usage, recycling, and disposal, must include sustainability concerns. The comparative advantage would be insufficient if attention were only paid to SC's internal efficiency. A SC firm develops a robust worldwide market when sustainable concepts are integrated into its basic activities. Companies are under tremendous pressure to modify their present SC to meet the demands of the current sustainable state as a result of the transition from conventional SCM to SSCM. SSCM is a management approach that incorporates social, ecological, and economic factors. Strong domestic rivalry amongst businesses is a result of the variety of customer demand, complicated product components, and worldwide competitiveness. SSCM creates the greatest talents for differentiating between enterprises and their rivals.

Concept of supply chain management:

Various academics have analyzed SCM. The disagreement over a specific SCM paradigm is not surprising given the relatively recent advancements in supply chain literature. SCM is a network of locations and storage choices that handles the functions of gathering information, processing it into intermediate and finished goods, and distributing it to the client. SCM is an aggregation activity that involves a network of installations that buy raw materials and distribute commodities to customers through a delivery chain, as well as an intermediate product supply. The supply chain is a network of organizations involved in a variety of upstream and downstream activities that add value to the ultimate customer's products and services. SCM provides a "strategic and thorough alignment of traditional business activities and strategies via

those organizations" inside a single company and among the businesses in a supply chain in order to improve the long-term productivity of particular firms and the supply chain in general. While the separation of the supply chain industry into several companies reduces experience and size, some fundamental challenges and concerns must be resolved in order for the supply chain to function efficiently—which is SCM's primary goal.

In the current economic climate, most analysis seeks to discover the best operational management techniques, and best-value supply chains are more likely to prevail in this battle. The fastest, most efficient, least expensive, and most flexible supply networks require strategic management of the supply chain to create consistency. Although this description is crucial for contemporary firms, little is known about how popular theories often explain how these chains are unique from others and thus wildly successful. The concept of greatest value supply chains may become clearer and deeper when examined from a variety of crucial analytical angles. The authors have shown how nine well-known theoretical perspectives cost-economic transaction, theory of agencies, theory of resource dependency, theory of institutional resources, game theory, theory of networks, social capital theory, strategic choice, and resource-based perspective/science have implications for the best value chain concept. On our own, we can state that before going into detail about the nine theories, it is crucial to note that a number of other theories, such as the behavioral theory of the firm, punctuated equilibrium, industrial organization, contingency theory, evolutionary economics, and population ecology, can also be used to explain supply chain phenomena.Despite being widely utilized, the concept of the value chain is nevertheless misleading, according to a recent review of the key ways in which the term "value" is employed in the disciplines of economics, marketing, policy, and operations. This review asserts that the chain of relationships between businesses is solely focused on resources, that supply and capital flow in opposite directions, and that value is a metaphysically perceived efficiency correlated with the advantages that exist at various exchange points in the resource chain. In terms of the flow of capital, the research claims that the value is intuitive and benefits both producers and consumers. Therefore, valuable chains may be seen of as having a two-way flow of value, with suppliers benefiting from the financial assets, payment terms, stability, and future order protection given by their customers and the consumers benefiting from the goods and services they provide.Evaluation and Improvement Techniques for SCMMany different methods and tactics for SCM evaluation have been put out over the years. Traditional strategies are founded on well-known financial principles including Internal Rate of Return (IRR), Net Present Value (NPV), Return Time, and ROI. The best techniques for determining relevance in fundamental SCM applications. Regrettably, later-generated SCM programs are not well-suited for assessment methods that emphasize financial indicators. The benefits offered by these dynamic supply networks are often many and all intangible. Let's finish with a strategy that is a set of theories about cause and effect while thinking about tactics. The company's goal and strategy won't be understood or conveyed if links between cause and effect aren't properly stated in the BSC. The causal links may include some or all four BSC points of view. For instance, the ability of service systems to adapt to specific client demands will increase the likelihood that they will satisfy consumer expectations. More innovative items and services will be produced by firms in response to rising customer expectations. Market share and earnings will increase in exchange.

There is no doubt about the need of providing information to the supply chain, and because IT, especially different internet apps, will significantly save costs, it is crucial to strategically prepare for and exploit this mechanism. Information should be easily accessible to all supply chain organizations, and business processes should be set up to make maximum use of the information. In the end, the most important determinants of SCM performance will be customer loyalty, supply chain competitiveness, and sustainability in general. However, new organizational tools and indices have been developed due to the fact that they are difficult to measure or utilize to monitor development. More information is available. The primary performance measures in the supply chain are more operationally total costs, quality, and lead times. Costs and customer response are the measures that are most often cited, according to a quality study.

The thesis investigates the possibility that general systems theory might aid in the improvement of our knowledge of supply networks. The first principle states that simpler supply networks should be chosen over more complicated ones in terms of their topology, kind, and character if firms' supply chains need to be agile or rapid reaction. According to the second idea, businesses must direct their operations toward managing their supply chains and provide more management resources to highly active networks than to less active ones. The third hypothesis aids firms in better understanding their supply chains by breaking down these operations into smaller, easier-to-understand subsystems. According to the Fourth Theory, businesses must recognize that supply networks are dynamic rather than static, and managers at both the top and bottom levels must focus on the potential changes that may be made as well as their implications on resources and the operation of the supply chain. Frequent inspections and improvements in management procedures would be anticipated in order to maintain supply chain performance.

CONCLUSION

Supply chain management (SCM), which comprises all procedures that convert raw materials into finished commodities, is the central administration of the movement of goods and services. Companies may reduce unnecessary expenditures and deliver goods to customers more quickly and effectively by optimizing the supply chain.

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CHAPTER 3

SUPPLY CHAIN MANAGEMENT PROCESS

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Abstract: The process of getting a product from a raw material to a consumer is called supply chain management. Supply management, product and demand planning, sales and operations planning, and supply planning are all included. In this chapter discuss about theprocess for managing the supply chain, including its functions.

Keywords: Demand Plaining, Functional Operation, Operational Plaining, Supply Chain Management, Supply Plaining.

1. Introduction

Supply chain management is the process of integrating supply and demand management across each of the various supply chain actors and channels in order to maximize their ability to work together effectively and efficiently. To ensure that their supply chain is effective and efficient, businesses use a technique known as supply chain management. A supply chain is a company's method of transforming raw materials into completed products, as seen in Figure 1. Activities in the supply chain are not the sole responsibility of one individual or one business. To make it operate, numerous people must actively participate in a variety of processes.Supply chain experts must take on similar tasks to succeed in the SCM "game". Each member of the supply chain must be aware of their responsibilities, devise winning tactics, and work together. The SCM team may flawlessly carry out the subsequent processes by doing this.The following is a discussion of the five fundamental elements of supply chain management:

Figure 1: Representation of Supply Chain Management Process.

Planning: In order to fulfil client needs, supply chain management must be proactive. Forecasting demand, consciously building the supply chain, and choosing how the business will assess the supply chain are all necessary to make sure that it is running as planned in terms of efficiency, offering value to consumers, and helping the organization achieve its goals.

Sourcing: Choosing the suppliers who will provide the goods, raw materials, or services required to make the finished product is an important phase in the supply chain. In addition to creating the contracts that govern the providers, this requires administering and monitoring present agreements.Strategic sourcing requires supply chain managers to oversee the processes for placing orders, collecting deliveries, checking stocks, and authorizing payments to vendors.

Making: Supply chain managers need to help with the coordination of all the stages involved in making the product itself. This covers the production of the items, quality assurance, and packaging. To ensure that general requirements are met, businesses often evaluate quality, production, and employee productivity.

Delivering: Because it guarantees that the items reach the clients, logistics are essential for the success of the supply chain. This includes all of the order coordination, delivery planning, dispatch, invoicing, and payment collecting activities. The items must generally be carried utilizing a fleet of vehicles, ranging from fleet trucks and parcel services handling last-mile delivery to tankers delivering commodities created overseas. Occasionally, companies enter into agreements with other companies to manage house deliveries or certain handling requirements.

Returning: Supply chain managers also need to create a network that makes it easy for products to be returned. This could mean scrapping or producing a faulty product in certain cases, or returning a product to the warehouse in others. The network needs to be reliable and flexible in order to satisfy customer demands. The foundation for each of these elements is a robust network of supporting practices that can effectively monitor the data across the supply chain and guarantee that laws and regulations are followed. Sales, quality control, finance, and human resource management are just a few of the many departments engaged in this.

Functions of **Supply Chain Management Process:**

Trying to control the flow of raw materials into an organization, specific internal procedures for transforming raw materials into finished goods, and the flow of finished products out of the organization and toward the final consumer are all components of the cross-functional strategy known as supply-chain management. As they seek to focus on their core capabilities and become more adaptive, organizations are losing control over the raw material sources and delivery networks. More and more often, these activities are sent to other companies because they can complete them more quickly or more reasonably. Consequently, more companies participate in satisfying consumer demand, but management control over ongoing logistical operations is reduced. Less management and more supply-chain partners led to the development of the concept of supply-chain management. The purpose of supply-chain management is to boost confidence and collaboration among chain participants, which will boost inventory visibility and movement velocity [1].

The effectiveness and affordability of information transfer, capital flow, logistics, and human resources across businesses are especially significant in this situation. The supply chain's operational mode may be efficiently improved and optimized with the use of Internet of Things technology[2], [3]. The creation of a supply chain management system based on Internet of Things technology is discussed as the current state of conventional supply chain management is analyzed. The optimization approach for e-commerce supply chain management based on Internet of Things technology is examined in the last section of this paper. This technology is a major supporter of the informationalization of e-commerce supply chain management. Small and medium-sized businesses can optimize the workflow and circulation links of the e-commerce supply chain management, enhance the matching level of product value and information transmission, improve the supply chain operation mechanism, and increase economic benefits through the application of Internet of Things technology.

2. LITERATURE REVIEW

Keely L. Croxton *et al.* [4]Supply chain management is increasingly understood to involve the control of important business operations across the network of businesses that make up the supply chain. While many have acknowledged the advantages of a process approach to managing the business and the supply chain, the majority are unsure of the processes that should be taken into account, the sub-processes and activities that each process contains, and the interactions between the processes and the conventional functional silos. The eight supply chain processes identified by participants in The Global Supply Chain Forum are each given strategic and operational descriptions in this paper. Additionally, we show how the processes interact with one another and give an example of how a process approach might be used within an organization. Our goal is to provide educators the resources they need to structure a supply chain management course, managers with a framework for implementing supply chain management, and researchers with a set of chances to advance the discipline.

KevinMccormack[5]According to the idea of process maturity, a process has a lifespan that can be evaluated based on how precisely defined, managed, monitored, and controlled it is. A maturity model presupposes that reaching goals involves many steps. The principles created by scholars over the last two decades served as the foundation for the supply chain maturity model described in this study. The capability maturity model, developed by the Software Engineering Institute, is another way that process maturity has been applied to the software development process. In order to improve supply chain performance, this article analyses the connection between supply chain management process maturity and performance. It also offers a model for supply chain management process maturity.

Sakun Boon-itt *et al.* [6]It has been extensively debated how supply chain management procedures may be used to achieve competitive advantages in the service sector. The consequences of the service supply chain management (SSCM) process capabilities, however, cannot be determined since there are no reliable measuring scales. In this work, measurement scales for SSCM process capacity constructs will be developed and validated. The measuring scales were first created via a literature study and then improved upon using the Q-sort approach. The SSCM process capacity is a seven-dimensional construct, where each dimension is made up of a number of multi-item scales that are unidimensional in nature. The unidimensionality, dependability, and validity of the multi - dimensional construct of the seven SSCM process capabilities were validated by confirmatory factor analyses of a large-scale survey. The verified

measurement scales enable future empirical investigations in the sector, which previously mostly depended on conceptual frameworks and descriptive descriptions of SSCM processes. This lays a critical basis for improving understanding of the service supply chain.

Mohamed Dawood Shamout and Okechukwu Lawrence Emeagwali [7]This article will address a number of empirical research looking at how customer satisfaction is affected by electronic supply chain management (e-SCM) procedures. An examination of the relevant literature revealed that just a few prior studies had made an effort to determine how e-SCM procedures affected customer satisfaction. As a result, this article will describe and explain the secondary source data that was gathered. The results of this research demonstrate how e-SCM procedures affect customer satisfaction. This study, which was based on a review of the literature, provides a foundation for future research in this area.

Rao Tummala and Tobias Schoenherr [8]This paper's goal is to provide a thorough and complete strategy for controlling risks in supply chains. Design/methodology/approach: This work proposes a systematic and ready-to-use method for managers to identify and manage risks in supply chains, building on Tummala all-risk's. Management Process (RMP). Findings: When using the supply chain risk management process, supply chain risks may be controlled more successfully (SCRMP). Risk identification, risk measurement, and risk assessment; risk evaluation; risk mitigation and contingency planning; and risk control and monitoring through data management systems are the stages that make up the structured method. There are recommended methods for carrying out this procedure in particular. Originality/value: Despite the fact that supply chain risk management is a new and crucial subject in our connected and dynamic world, conceptual frameworks with a clear definition and normative guidelines are few and far between (Manuj and Mentzer, 2008). This essay offers managers a framework for making decisions by providing structure. Publishing Company Emerald Group.

Douglas M. Lambert [9]The goal of supply chain management is to increase customer happiness, streamline the manufacturing process, and lower overall labour costs. Supply chain management is unquestionably significant and garners a lot of interest from both corporations and academic researchers. Numerous significant research accomplishments and outcomes had been made. The planning, coordination, operation, control, and optimization of the whole supply chain system are all included in the research on supply chain management. This book includes a compilation of current contributions from scholars throughout the globe that include novel techniques and creative concepts. It aims to provide supply chain management researchers, scientists, engineers, and students a useful reference of fresh perspectives, innovative findings, and real-world examples on this cutting-edge topic.

3. DISCUSSION

In order to get items to customers, both small and big firms need a highly-detailed system called SPLY change management, which covers the procurement of raw materials, production, and delivery of the finished product to the client. In a well-designed supply chain management system, operational functionality is optimised for speed and effectiveness. Supply chain management has become a crucial component of business nowadays more than ever before and is crucial to the success of any organisation and consumer happiness. Supply chain management

has the ability to increase customer satisfaction, save operational expenses, and strengthen a company's financial position. Businesses are discovering that in order to compete in the global market and networked economy, they must depend on efficient supply chains or networks. This idea of business partnerships goes beyond conventional organisational boundaries in Peter Drucker's (1998) new management paradigms and aims to coordinate complete business activities throughout a value chain of many businesses. Many companies, including Dell and Hewlett Packard, have been able to successfully run collaborative supply networks where each specialised business partner focuses on just a few key strategic activities in recent decades thanks to globalisation, outsourcing, and information technology. It is possible to recognise this interorganizational supply network as a novel kind of organisation. The network structure does not fall into either the "market" or "hierarchy" categories, nevertheless, due to the intricate interconnections between the actors. Companies in a supply network often focus on the inputs and outputs of the processes, with little attention paid to how other individual participants' internal management functions. Therefore, it is recognised that the choice of an internal management control structure affects the performance of local firms.

The goal of supply chain management is to increase operational efficiency inside a business, not only to reduce costs and balance the budget. Even though they are a component of the whole ecosystem, contemporary supply change management also includes the strategic alignment of all business processes from beginning to finish in order to maximise market and economic value and provide a company an edge over their competitors. The beginning of the digital era has recently brought about a complete shift of the business sector. These procedures were difficult, time-consuming, labor-intensive, and unorganised only twenty years ago. Although shipping times have decreased from two weeks to a month to, in some circumstances, just a few hours, they may now feel like ancient history. Supply chain management and the rise in demand for it have been made possible by automated systems and fast communication. In essence, the whole planet may be seen as one giant supply chain. A product passes through several hands before reaching its destination, and consumers and producers are continuously in communication with one another. Major concerns include the development of international firms, alliances, worldwide brand extension, and outsourcing are dealt with by supply chain management. Supply chain management is impacted by everything that happens in the globe, including changing gas costs and environmental issues. The single most significant area of business today is SCM, which has become more integrated. It is impossible to exaggerate the value of a well-functioning supply chain. Business interruptions (BI) now account for a greater percentage of property damage than they did ten years ago, according to a survey from Allianz SE.

Every society's basis must include SCM. For instance, supermarket operations work with a broad range of manufacturers and are crucial to supplying items to customers. Many different types of residents who depend on supermarkets for survival may be harmed if a supermarket sector does not have a strong supply chain management division. A supply chain that uses an integrated approach to management may satisfy the demands of both producers and consumers. Business has a significant influence from supply chain management. SCM that works well may immediately enhance customer service. To please both manufacturers and distributors, the proper product in the appropriate amount must be provided on time.

Customers want to be able to find out where to go in order to buy the products they desire. Customers also want excellent customer service. A company's supply chain management divisions must reassure customers that they will get their items as soon as feasible if things are not dispersed on schedule. SCM has a significant effect on a business's bottom line as well. Good supply chain managers are highly valued by large organizations because they increase the effectiveness of factories, warehouses, and transportation facilities in a supply chain. Because customers may buy their products when a product is delivered on time, cash flow is instantly improved. To satisfy consumer demand and expectations, supply chain procedures are also evolving. Supply network topologies have gained widespread recognition as a novel organizational type. Generally speaking, such a structure is "a number of semi-independent organizations, each with their own competencies that work in ever-changing constellations to service one or more markets in order to accomplish some commercial purpose particular to that partnership". Management of the supply chain is crucial for organizational learning. Businesses with supply chains linking various trade cliques that are geographically more widespread have a tendency to become more inventive and productive. The active management of supply chain operations is known as supply chain management (SCM), and it is done to increase customer value and create a long-lasting competitive advantage. It shows a deliberate effort on the part of supply chain management companies to create and manage supply networks as effectively and efficiently as they can. Product creation, sourcing, manufacturing, logistics, as well as the information systems required to coordinate these operations, are all covered by supply chain activities. A supply chain is the interconnected system of people, businesses, organizations, assets, processes, and technology used in the production and distribution of a good or service. The beginning of a supply chain is the distribution of raw materials from a supplier to a manufacturer, and its conclusion is the delivery of the completed product or service to the customer. The primary goal of SCM is to provide organisations a tactical edge via cost reduction while maintaining or even improving customer satisfaction. Additionally, the capacity for supply chain performance to sustain competitive advantage depends on the capacity to comprehend the environmental factors that drive the SCM and clearly identify the obstacles and execute solutions or bridges. Leveraging the knowledge, skills, experience, and capacities of the SCP who make up this competitive network is SC's primary objective and key componet. Many obstacles stand in the way of businesses adopting integrated SC practises and procedures. In their 2008 evaluation of current scientific research on possible impediments to SCM, Fawcett *et al.* They divided the obstacles into two groups: management complexity and inter-firm competition. Under the heading of "inter-firm competition," they identified the following obstacles, listed in order of importance: internal and external turf battles, subpar SCM planning, a lack of SCM vision, a lack of trust, executive commitment, and subpar SCM knowledge[10].All of these obstacles hinder SC's ability to be agile, thus management should lessen their influence. Internal and external turf conflicts, the biggest obstacle, need immediate attention from SCPs because of their rapid and severe negative effects that disrupt the SC. Although its repercussions may take time to manifest, SC failure is characterized by poor planning and a lack of vision. Misaligned SC procedures, structures, and significant variances in the corporate cultures of SCPs are all examples of managerial complexity. Additionally, identified the following impediments in the management complexity category, listed in order of importance: limitations in IS/IT, organizational structure and culture, a lack of SC assessment, and a lack of alliance rules. Due to the fact that these issues exist at both the business and SC levels, it is necessary to address them from both angles. The SC as a whole loses competitive advantage due to the worst IS/IT shortcomings. In their 2008

evaluation of putative SCM barrier remedies in the academic literature, Fawcett *et al*. In descending order of importance, they listed the following feasible solutions: information transparency, CFT/CF collaboration, collaborative planning, IT architecture/internet, formal performance tracking, adopt strategies SCM vision, attention to human factors, supplier certification/reduction, target segmented customers, and shared investment/benefits. In their review of the literature on the key benefits of SCM, the following benefits in the following order of importance: higher inventory turnover, higher revenues, lower SCM costs, product availability, shorter order cycles, responsiveness, economic value added, capital utilization, shorter time to market, and lower logistics costs.

The reason why businesses should actively manage their supply chains is the next crucial point. Costs associated with transferring money, producing components, storing them, and transporting them are all part of the supply chain. The entire cost of the supply chain tends to rise as a result of a number of factors, including the enormous capital expenditures necessary to operate international enterprises, rising real estate expenses, and fright fees. In contrast, flawless SCM planning for material delivery, manufacturing schedule, and distribution decreases the time and energy lost, as well as inventory and inventory cost. Across a variety of sectors, supply chain management significantly changes inventory investment and helps control economic volatility. SCM is discovered to include all aspects of planning, production, and operations management required to launch a product into the market, from the acquisition of raw materials through the delivery of the finished item. The features and problems that must be controlled in the supply chain will be discussed in this section.A principle known as supply chain management (SCM) emphasizes the use of an effective integrated system of suppliers, producers, warehouses, retailers, and customers in order to produce and distribute goods throughout the system at the proper quantities, locations, and times in order to reduce costs and maximize services. A supply chain is the connection of several businesses with facilities, roles, workflows, and logistical operations involved in creating and delivering a product or service. In the past, "risk" was less distributed and simpler to control when businesses produced in-house, sourced locally, and sold directly to the consumer. Risk is rising, and its location has changed due to complex, shifting supply networks brought on by the development of more sophisticated goods and services and outsourcing of supply networks across international boundaries. An essential aspect of supply chain management is risk management. The topic is crucial due to a number of industry trends that are currently in play, including the rise of information technologies that enable the management and coordination of extended supply chains, the globalization of markets, the increasing reliance on suppliers for specialized capabilities and innovation, and the increasing reliance on supply networks for competitive advantage. Low cost country (LCC) sourcing, cooperation with international supplier partners, and a surge in outsourcing and offshoring of manufacturing and R&D operations are some manifestations of these developments. These expand the strategic alternatives available to businesses, but they also raise the likelihood that supply chains can experience unfavorable events that seriously jeopardize the regular operations of the businesses involved. The likelihood and size of supply chain risks have increased along with the number of these projects. Numerous industrial incidents have shown varying results after risk occurrences as a result of various responses (or lack of responses) to supply chain disturbances and interruptions. The 2004 Ericsson crisis is a prime illustration of this. A fire catastrophe at the supplier of Ericsson's chips caused an immediate disruption in the material supply because of the company's single-sourcing strategy.

A principle known as supply chain management (SCM) emphasizes the use of an effective integrated system of suppliers, producers, warehouses, retailers, and customers in order to produce and distribute goods throughout the system at the proper quantities, locations, and times in order to reduce costs and maximize services. A supply chain is the connection of several businesses with facilities, roles, workflows, and logistical operations involved in creating and delivering a product or service. In the past, "risk" was less distributed and simpler to control when businesses produced in-house, sourced locally, and sold directly to the consumer. Risk is rising, and its location has changed due to complex, shifting supply networks brought on by the development of more sophisticated goods and services and outsourcing of supply networks across international boundaries. An essential aspect of supply chain management is risk management. The topic is crucial due to a number of industry trends that are currently in play, including the rise of information technologies that enable the management and coordination of extended supply chains, the globalization of markets, the increasing reliance on suppliers for specialized capabilities and innovation, and the increasing reliance on supply networks for competitive advantage. Low cost country (LCC) sourcing, cooperation with international supplier partners, and a surge in outsourcing and offshoring of manufacturing and R&D operations are some manifestations of these developments. These expand the strategic alternatives available to businesses, but they also raise the likelihood that supply chains can experience unfavorable events that seriously jeopardize the regular operations of the businesses involved. The likelihood and size of supply chain risks have increased along with the number of these projects. Numerous industrial incidents have shown varying results after risk occurrences as a result of various responses (or lack of responses) to supply chain disturbances and interruptions. A fire catastrophe at the supplier of Ericsson's chips caused an immediate disruption in the material supply because of the company's single-sourcing strategy.

The architecture of the supply chain for a manufacturing company is based on efficient integration. Several viewpoints on integration have argued that integrating multiple organizational levels' worth of operations may lead to above average financial and performance outcomes. It has been noted that existing static techniques and theoretical models fail to take all factors and restrictions into account when constructing supply chains. The integration of the "lean" and "agile" philosophies. They created a route map for integrating lean production and agile supply across the whole chain as well as an overall performance measure. That it could be challenging to fully comprehend the dynamic complexity of the processes and systems observed as one of the causes of this. The performance of the supply chain might be improved by using recent advancements in systems thinking and continuous system simulation within the framework of an operation management framework. Performance assessment is crucial as a strategic tool since it offers ways to meet the necessary goals and realise a company's purpose and strategy. It has been noted that many businesses mainly consider cost and efficiency when evaluating performance. Because of this, the majority of metrics now concentrate on financial information such return on investment, return on sales, price variations, sales per employee, productivity, and profit per unit of production, among other metrics. The firms have been using novel business strategies and performance improvement programmes like TQM, JIT, and SCM as a consequence of globalisation and competitiveness. The numerous supply chain performance assessment criteria. SCM practises are a collection of actions made by an organisation to support efficient supply chain management. Supply base management, as is the coordination of the manufacturing, logistics, materials, distribution, and transportation functions within

organisations. It also refers to how businesses use the processes, technologies, and capabilities of their suppliers to gain a competitive advantage. Many businesses have cut down on their supply base in order to better manage their interactions with important suppliers. Companies that have issues as a result of their greater dependence on suppliers use a range of strategies to fix the issues. They might shift their focus away from shrinking and bring previously outsourced goods and services back in-house, find new sources of supply, or collaborate with current vendors to improve their capabilities and performance (Watts and Hahn, 1993). The purchasing company's efforts and the range of instruments used in supplier development activities differ. According to businesses often employ supplier assessment or performance measurement to pinpoint particular supplier shortcomings and create remediation strategies. These initiatives could include performance targets for suppliers, site inspections, certification of suppliers' goods and procedures, and evaluation of suppliers' delivery, quality, and cost performance. The use of quality assurance systems for monitoring suppliers' processes and goods, the use of site visits, and the exchange of information with suppliers are practises used to manage the supply base efficiently and improve supplier performance.

4. CONCLUSION

Gaining the confidence of their team members, superiors, subordinates, clients, and other stakeholders is one of an effective manager's most crucial tasks, they understand. They also understand how crucial it is to establish organizational procedures and frameworks that foster trust at all organizational levels.SCM manages every stage of a product or service's lifecycle, from original conception to ultimate sale. With so many points throughout the supply chain where inefficiencies may add value or lose value due to higher costs, effective SCM can boost revenues, save costs, and have an influence on a company's bottom line. As a result, more businesses are engaged in meeting consumer demand, but management oversight of ongoing logistical operations is diminished. The idea of supply chain management was developed as a result of less control and more supply chain partners. The goal of supply chain management is to increase cooperation and confidence among stakeholders in the chain, which will increase inventory visibility and movement velocity.

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CHAPTER 4

DECISION PHASES IN A SUPPLY CHAIN MANAGEMENT

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Abstract:

Supply chain strategy (or design), supply chain planning, and supply chain operation are the three decision processes that take place inside a supply chain. Decisions affect how information, goods, and money move. Designing a supply chain plan, supply chain management, supply chain operation, and drivers in the supply chain are discussed in this chapter.

Keywords:

Decision Making, Production, Supply Chain Management, System, Transportation.

INTRODUCTION

Making choices about how information, goods, and money flow needs numerous considerations for successful supply chain management. Depending on how frequently each decision is made and the length of time that each decision's effects last, these decisions can be divided into three groups or stages. On total profitability and success, a supply chain's design, planning, and management have a significant impact.

Designing a Supply Chain Plan

The supply chain is structured and configured during this phase, including how resources will be distributed and what functions each stage will carry out.

Companies' strategic choices include:

1. Locations and production and warehouse facility capacity for the various sites where products will be produced or stored
2. Accessible forms of transportation along various ships legs.
3. Kind of information system[1]

Decisions on supply chain design are frequently taken for the long term (measured in years), and last-minute changes might be pricey. As a result, a corporation must consider the uncertainty of the predicted market conditions over the coming years while making these selections.

Supply Chain Management:

A quarter to a year is taken into consideration at this phase. A demand projection for the following year serves as the first step. As a result, the supply chain's strategic phase structure is set in stone. The configuration sets limitations that must be considered when planning. A supply

chain's operating parameters are established by planning for a given time frame. Companies begin the planning process by forecasting demand across several markets for the upcoming year. Planning decisions include those relating to the markets that a specific production facility will serve and the intended production volumes at various sites. The businesses must factor unpredictability in demand, exchange rates, and competition into their decisions across this time period. Companies in the planning phase attempt to leverage any flexibility built into the supply chain in the design phase and exploit it to improve performance given a shorter time horizon and better forecasts than the design phase. In order to control short-term operations, businesses create a set of operating policies[2]–[5].

The supply chain planning choices made are as follows:

1. Planned stockpiling of goods
2. Time and scale of market promotions
3. Backup sites for inventories
4. Inventory policies

Supply Chain Operation:

Decisions are made by businesses on specific customer orders throughout a weekly or daily time frame. At the operational level, planning procedures are already established and the supply chain configuration is regarded as fixed. The optimum way to manage incoming customer orders is the objective of supply chain operations. The following actions are conducted during this phase:

1. Businesses allocate stock or production to specific orders.
2. Decide when an order should be fulfilled
3. At a warehouse, create pick lists.
4. Allot a purchase to a specific shipping method and shipment
5. Set truck delivery schedules
6. Place resupply orders

Due to the fact that operational decisions are being made with a short-term horizon, there is less uncertainty regarding demand information (minutes, hours, or days). During the operation phase, the objective is to maximize performance and take advantage of the reduction in uncertainty.The key objective in this situation is to carry out the operating policies as successfully as feasible.

Drivers in the supply chain

Supply chain performance is determined by supply chain drivers. Managers must compromise between efficiency (cost) and reactivity for each driver. Supply chain factors include:

A. **Inventory:** Within a supply chain, it consists of all raw materials, work in progress, and final commodities. Due to imbalances in supply and demand, inventory is kept in the supply chain. While increasing inventory improves responsiveness, it also raises the expense of carrying that inventory.
B. **Transportation:** This refers to the act of transporting inventory from one location to another within the supply chain. When establishing a supply chain, several decisions

about transportation must be made. There are six primary forms of transportation: air, truck, train, ship, and pipeline digital transportation.

C. **Facilities:** Facilities are locations where inventory is made, assembled, or kept. As a result, facilities can be divided into storage and production facilities. Location, capacity, production techniques or technology, and storage techniques are all decisions connected to facilities.
D. **Information:** It includes of data and analysis findings pertaining to funds, customers, orders, facilities, transportation, and inventories. Good decisions are driven by good knowledge [6]**.**

A strong and efficient shop network administration produces a smooth operation of a company, high-quality products or prospective advantages, which increases customer trust and boosts sales. All decisions that must be made in order to proceed correctly in order for an association's business to reach this stage. These decisions are often the results of earlier experiences and outside knowledge that have been absorbed to provide knowledge or learning. Consequently, a decision support system is herein proposed to be able to combine data from the three primary decision phases of a supply chain management, namely: (1) supply chain design (Strategy) phase; (2) decision in supply chain management (Planning) phase; and (3) operational level (Operation) phase. By providing information that will aid the hierarchical basic leadership process, this suggested framework is focused on enhancing the process of basic leadership[7].

Information on the optimal locations for each stage of the retail supply chain is needed for the buying choices. The suggested approach is a comprehensive tool for reducing transaction costs in the retail supply chain. The model demonstrates not just supply chain choices made at the firm level by lean management, but also the precise steps needed to increase supply chain competitiveness. The allocation model also demonstrates how manufacturer, distributor, and retail organisations distribute their purchasing choices[8]. The scale of the logistic expenses, the mechanism used to determine supply chain purchasing choices, and the ultimate demands of the consumers may all have an impact on how complicated the allocation model is. The lean management methodology could save a firm, but the outcomes don't always improve supply chain competitiveness as a whole. This article presents a model strategy that demonstrates how to take advantage of integrated inventory management choices at the lowest possible cost. One of the key components of this study is how the consequences of buying choices are incorporated into the whole retail supply chain in addition to the results of lean management. This kind of integrated strategy may increase profitability and supply chain effectiveness by an exponential amount. In the study, critical topics from the perspectives of shippers, truck owners and operators, transportation policy makers, and carriers are explored. Discussed are various transportation capacity, their prices, and their performance characteristics from a lean perspective.

Phuoc Luong Le *et al.* [9]In order to determine the current priorities and examine the future directions of decision-making in construction supply chain management, this research employs a comprehensive literature review technique (CSCM). The findings indicate that the internal supply chain (SC) integration of the CSCM apps is still primarily used to manage materials and

resources at this time. In the early stages of planning and design, strategic choices on forming alliances, IT-based planning, and logistics-based planning are not made. A framework is suggested to take advantage of the three key aspects for future CSCM application trends: collaborative planning and design with cutting-edge methods; lean procurement with BIM and third-party logistics; and the use of Lean and BIM in construction operations and delivery. In order to offer CSC choices throughout the stages of a construction project with the use of relevant SC methodologies and tools, this paper's novel contribution attempts to identify CSC decisions.

Drug shortages are a serious public health issue, particularly when it comes to medications for illnesses that pose a danger to life. Almost all nations had a range of supply issues and spent a considerable amount of time and money addressing the shortfall. The purpose of the current research is to identify, rank, and evaluate several techniques in order to find the best answers to these significant healthcare system difficulties. Methods: The study was undertaken in two parts in order to meet its goals. Choosing the best solutions to deal with the medicine scarcity and ranking them in order of importance. A self-design questionnaire was created for each step. Regulatory, financial, supply chain, information system, and policy-making were the five key management strategy aspects. From the literature, 45 options were culled, assessed, and narrowed down to 37 ways based on the advice of specialists. In the second phase, the multiple criteria decision-making (MCDM) techniques were used. By using the Analytic Hierarchy Process (AHP) approach, five significant factors were considered, including cost, time, labour, legal compliance, and culture. Then, 37 options were scored using the TOPSIS technique's five criteria for order of preference by similarity to the ideal solution. Results: The 20th, 24th, and 25th alternatives, which relate to supply chain (SC) and information system (IS) dimensions, are "Creating integrated Supply chain information system to manage medicines inventory in the country," "Creating and using the databases to predict the shortage of medicines," and "Using track and trace system." From the perspective of experts, these alternatives are given higher priority. The findings indicate that the IS dimension has a 100% priority rating; after that, policy and supply chain are ranked higher, respectively. In order to support patient care, health systems depend on reliable pharmaceutical supply. Information systems, policymaking, and supply chain are among the top objectives, according to the data. Through greater stakeholder participation, the warning system has to be upgraded to the advance system. Additionally, the competence of the Iranian FDA to regulate the country's pharmaceutical industry needs to be strengthened.

Few effective methods for preventing food loss and waste (FLW) using a circular supply chain management strategy are known. This study's objective is to evaluate the FLW Reporting and Accounting Standard's contribution to FLW occurrence detection and assessment across the agri-food supply chain. In order to help businesses execute a circular supply chain strategy for successful decision-making based on the idea of waste hierarchy, the 3R and 4R principles, our goal is to explain how this FLW is then reused from a circular economy (CE) viewpoint. Design/methodology/approach: This research offers a thorough examination of Barilla's soft bread supply chain. This study looks into how the FLW standard is being implemented by (1) identifying the main enablers and obstacles in measuring FLW throughout the entire production system, (2) offering a helpful standardised tool for sustainable FLW measurement, minimization,

and reuse in other agricultural supply chains to enable circular economy approaches, and (3) developing a decision-support strategy to use within the company for effective decision-making Findings: Since almost nothing is lost or wasted and the value of resources is recovered through reuse thanks to a systematic and integrated measurement, representing a basis for effectively minimising waste, the analyses performed throughout Barilla's soft wheat bread supply chain provide an interesting example of a circular management system. In order to obtain a thorough accounting framework for precisely quantifying and reporting the overall amount of waste generated in the various stages of food production, paying particular attention to ex ante prevention initiatives and ex post assessment actions, it is crucial to develop an interconnected supply chain management. Originality/value: In order to develop a decision-support tool that also includes the identification of the primary enablers and impediments to the implementation of a thorough standardised accounting process that would enable businesses to reduce-reuse-recycle losses and waste throughout the entire production process, an interdisciplinary approach integrating circular economy and supply chain management research streams was adopted. This research differs from others already published in the literature in that it focuses on the organizational implications of FLW assessment.

The e-waste industry has seen tremendous expansion on a worldwide scale, and as a result, its risk management aspect still needs further research. This study proposes a new Risk Awareness Indicator to address the gap left by the lack of a comprehensive method to risk identification and assessment in e-waste management (RAI). The new index is to be calculated using an integrated Multi-Criteria Decision Analysis (MCDA)-Analytic Hierarchy Process (AHP). Twenty of the Big Four's newest experts will submit weights and values (generation-Z and millennials). In the phases of collecting, transport, and processing of e-waste, cyber hazards involving personal data, environmental risks, and financial and economic risks, respectively, are crucial. Alternatives like landfills have a greater danger than recycling options. The findings may assist policy makers in introducing administrative and legislative simplifications to boost recycling supply chains and make them more effective and robust after the pandemic disruption in order to reach the circular economy objectives established at the European Union level. While the approach used to create the RAI index makes it simple to duplicate the study to other social contexts and other waste supply chains, the emphasis of this work is on e-waste and the opinion of screenagers consultants.

Sustainable supply chain management requires sustainable supplier selection and order allocation (SSSOA). It is a complicated, multi-faceted decision-making process that is enhanced by the sustainability triple bottom line. In order to handle an SSSOA challenge for the multi-echelon renewable energy equipment supply chain (Solar PV Panels), this study provides a multi-phase decision framework. The framework combines fuzzy multi-objective mixed-integer non-linear programming with fuzzy multi-criteria decision-making approaches. The supply chain's multi-period, multi-modal transportation network was optimised for the many economic, environmental, and social goals. The findings demonstrate that the cost of the product, the environmental management system, and the health and safety rights of workers are the three sustainable factors that matter most to decision-makers among the many that were chosen for this research. The outcomes of the mathematical model showed how multimodal transportation

affected total cost, time, and environmental effect throughout all time periods. Transfer costs and customer clearing costs were shown to be important contributors to total costs after a results analysis. Additionally, it was found that the defect rate was very important in choosing suppliers and allocating orders.

DISCUSSION

A management technique known as supply chain management (SCM) controls how products are moved inside and outside of an organisation. Making choices about how information, goods, and money move through an organisation is necessary for effective SCM. SCM covers all processes used to turn raw materials into final products. It also involves the designing, planning, carrying out, managing, and overseeing of all supply chain operations.The organisation selects how to define the supply chain for the next years during the first phase. The configuration of the supply chain includes resource allocation, manufacturing methods, storage, and various forms of transportation. These supply chain-related choices are all often made with the long term in mind.

Phase of Supply Chain Planning

In the second phase, businesses are ready to optimise their performance by incorporating flexibility into the supply chain. In-time manufacturing, production for customised orders, and the selection of the appropriate delivery option for each product are all included in this step. This phase also includes comparing business tactics to those of rivals and implementing best practises throughout the whole organisation. Decisions about the supply chain are often made for a few weeks or months.

Phase of Supply Chain Operations

The third and final decision-making process comprises planning, daily or weekly manufacturing, and product distribution. During this phase, incoming and outbound activities (inside and outside the organisation) are planned. Together with the suppliers, production facilities, and distribution centres, it involves determining the supply dates and means of transportation.

Phases of supply chain decision-making

A lot of decision-making is necessary for effective supply chain management about the transfer of information, goods, and money. Every choice must be elevated to supply chain excess. These decisions are divided into three stages based on how often they are made and how long they have an effect. Each choice category must thus take uncertainty across the decision horizon into account. a choice or strategy for the supply chain During this stage, a business chooses how to set up the supply chain over the next years based on the marketing and pricing strategies for a product. It determines the change configuration, resource allocation, and the operations carried out by each step.… additional material Dabur thought there was a great chance to improve customer service, lower working capital, and lower the cost structure.

It was difficult for the management to further boost the company's efficiency because of its high level of productivity in order to boost profitability and the bottom line. Dabur management was able to fully realise the potential of a supply chain exercise throughout the company with the use

of IT. Various levers It was found that missed sales might generate 6% of the revenue in additional revenue. Cost reduction was mentioned as a potential area for the business to increase profits. About 10% of the current expenditure was on damaged products. Demand planning (DP) and supply network planning (SNP) SAP APO modules have been adopted by the firm and integrated with a few existing legacy systems[10].

Supply Chain Management (SCM), a dependent or autonomous system of a stream of materials or data moving from suppliers to end consumers, serves as an essential component of every firm. As a result of globalization, the trade industry has come to rely on supply chain management to bring the globe closer via collaboration and coordination across various logistical authorities. A supply chain management involves making a lot of decisions related to the flow of data, items, and assets. To increase the excess of the shop network, every decision should be taken. Systems called decision support systems (DSS) are set up to assist supply chain stakeholders in making choices that are based on information or data collected from a portion or the full supply chain pipeline. Its importance in every industry or in the flow of commodities cannot be overstated. At some point or another, a supply chain is connected to a number of risks and uncertainties. The need of a DSS to assist reduce some of these risks may be seen in the fact that some of these linked dangers may be freely and clearly evident while others may require technical or crucial processing of information that may be concealed in complicated data. By consolidating the demand and supply indicators that regulate the flow of goods and services in the supply chain pipeline, the DSS can further help reduce costs by giving stakeholders the opportunity to automate processes, eliminating the high rate of errors associated with all human interventions.

Supply chain management (SCM) is a notion that being increasingly used in a range of industrial industries to boost corporate performance, including quicker fulfilment of the various consumer needs, reduced costs, and higher quality. The implementation of SCM ideas in the construction industry helps project managers make strategic decisions, build relationships with suppliers, and increase operational construction efficiency. However, since the 1990s, it has been understood how crucial SCM is to enhancing construction management. The contentious question of whether SCM should be applied to the construction industry owing to its differences from the manufacturing sector was a major topic of discussion in papers during this particular time period. Up until the 2000s, research studies were primarily concerned with the analysis and exploration of the pertinent aspects of SCM in the construction industry, particularly after Vrijhoef and Koskela's (2000) introduction of the four roles of supply chain management in the industry inspired many academics to pursue the topic.

The understanding of using SCM in construction management has changed over the last several decades. Beginning in the year 2000, construction supply chain management (CSCM) academics concentrated on examining certain elements, such offering viewpoints on construction supply chain integration. They also discuss the knowledge, attitude, and skill required for partnerships in the construction supply chain, and how to implement SCM in the construction sector. Many writers were interested in creating in-depth frameworks for addressing and implementing management issues with CSCs in the middle of the 2000s. For instance, a conceptual framework for mature CSC, an agent-based framework for supply chain coordination in the construction

industry, and a dynamic reputation incentive model in CSC (Chen and Ma 2008) are just a few examples of application attempts. Researchers have recently focused on a variety of techniques and instruments that are combined with CSC to increase performance effectiveness. The Lean concept is used to enhance CSC cooperation. Used simulation to model logistics, while used meta-heuristic algorithms to optimize logistics.

Supply Chain Management (SCM), a dependent or autonomous system of a stream of materials or data moving from suppliers to end consumers, serves as an essential component of every firm. As a result of globalisation, the trade industry has come to rely on supply chain management to bring the globe closer via collaboration and coordination across various logistical authorities. A supply chain management involves making a lot of decisions related to the flow of data, items, and assets.

To increase the excess of the shop network, every decision should be taken. Systems called decision support systems (DSS) are set up to assist supply chain stakeholders in making choices that are based on information or data collected from a portion or the full supply chain pipeline. Its importance in every industry or in the flow of commodities cannot be overstated. At some point or another, a supply chain is connected to a number of risks and uncertainties. The need of a DSS to assist reduce some of these risks may be seen in the fact that some of these linked dangers may be freely and clearly evident while others may require technical or crucial processing of information that may be concealed in complicated data. By consolidating the demand and supply indicators that regulate the flow of goods and services in the supply chain pipeline, the DSS can further help reduce costs by giving stakeholders the opportunity to automate processes, eliminating the high rate of errors associated with all human interventions.

Several businesses have successfully used supply chain management (SCM) to address industrial issues. It improves operational planning and execution, lowers overall costs, and raises the quality of client service. The aeronautics sector also makes extensive use of SCM methodologies. In this area, the supply chain is referred to as a sophisticated assembly system that is typically managed by the company that makes the finished product. In fact, this business mandates operational tactics to provide a competitive edge for every supply chain participant. Additionally, this ultimate business may enforce strategic and tactical judgements since they are centralised. The primary feature is that completed goods must be constructed in response to a client request; there is often no inventory of finished goods. When comparable to the car sector, consumer demand is also erratic and characterised by large product diversity, low production numbers, and both. Additionally, due of the high demand and lengthy manufacturing lead times, finished items may not be delivered for many months.

The challenge presented by an aviation engine manufacturer that is dealing with a sharp rise in demand, a lack of supply, and lengthy manufacturing lead times for new items that have just entered the market. Because suppliers seldom collaborate and synchronise their efforts, the supply chain is loosely connected. When introducing new products, it is necessary to quickly identify the best supply chain that fits with enterprise strategy, establish strong partnerships between supply chain actors to reduce uncertainty, reduce long lead times, increase velocity and visibility of parts in the supply chain, minimise total supply chain costs, and improve other

metrics like deli. Planning inventories is a major problem in SCM and unpredictability is a crucial element that we must consider in this situation. By positioning safety stocks in key locations, variability may be protected against. However, due of the dynamic nature of the system and the interdependencies between all supply chain participants, calculating the best safety stock amounts to hold is difficult.

CONCLUSION

When making choices, one should constantly consider both the good and bad effects on the company and should lean toward the favorable results. As a result, potential losses to the organisation are avoided, and the business continues to expand steadily.Successful supply chain management is the consequence of strong decision-making stages. Making educated judgments about the creation, organisation, and operation of a supply chain helps a company succeed financially.

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CHAPTER 5

DISTRIBUTION STRATEGY IN SUPPLY CHAIN MANAGEMENT

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Abstract:

A distribution strategy is a way to get products or services out to consumers. Implementing the most effective distribution strategy for your company is essential for generating income and maintaining clientele. To cater to various customer bases, some businesses choose to employ several distribution channels. This chapter discusses different distribution systems, strategies for distribution management, and the advantages of distribution management strategies.

Keywords: Distribution, Management, Marketing, Strategy, Supply Chain Management.

INTRODUCTION

Distribution through the supply chain is how companies reach their target markets with their goods. Plans for distribution are heavily influenced by the company's financial objectives. While some businesses choose to employ third parties for distribution, others opt to sell products directly to their customers. Supply chain distribution needs to be established through an organized plan in order to be successful. It is anticipated that businesses will evaluate the various distribution alternatives available to them and select the one that is best for their client base and product line while developing the plan[1]–[3]. The number of days between when a consumer places an order and delivery is decreased through formal distribution arrangements. Companies that have a thorough distribution plan can fulfil orders in as little as two days. Those without a distribution strategy take ten days in contrast. Supply and demand are balanced through supply chain distribution. Any form of market change, such as a reduction in supply or an increase in demand, should be accommodated in distribution strategy.

Several of the various distribution methods

There are numerous ways for businesses who decide to use an indirect distribution technique to get their products into the hands of consumers. Here are a few of the middlemen that companies employ to carry out their distribution plans.

1. **Wholesaler:** A wholesaler's job is to purchase goods in large quantities from producers and then sell them to retailers. They typically look to purchase things at a discount so they can mark them up and profit when selling them to merchants, who then markup item prices even more to generate their own income. Retailers can choose from a catalogue of purchased items that wholesalers typically keep in their own warehouses that they can choose from when making purchases. Many wholesalers also demand that merchants purchase a predetermined quantity of their items, therefore products are typically bought in bulk.

2. **Retailer:** Retailers are the last stop in the distribution chain before customers make a purchase when using the indirect distribution approach. Retailers have the option of purchasing products directly from manufacturers or from wholesalers. Typically, retailers buy goods at a discount and mark them up later to make a profit. Retailers don't have have physical locations; they can also conduct business over the phone, online, or even through catalogues. Due to the widespread use of the internet, many businesses choose to operate an online store rather than a physical location to conduct business.
3. **Franchisor:** A completely different method of product distribution is franchising. Probably already familiar with the concept of franchising. For example, a franchisor may control neighborhood McDonald's restaurant if they have a license from the McDonald's corporation to market products under the brand. In the United States, there are currently 732,800 franchisees, according to a 2016 analysis by FRAN data and the IFA. These independently held companies can leverage brand recognition to increase sales in exchange for a one-time setup fee and monthly royalties. This tactic generates income for businesses and producers with well-known brands without requiring them to handle the minute day-to-day operations involved with a brick and mortar store.
4. **Distributor:** A distributor's job is to acquire products from producers and deliver them to retailers or other endpoint places. Utilizing a dedicated distributor has the advantage of relieving producers of the logistics of shipping and the expense of keeping shipping personnel and supplies. Distributors might also be able to combine various products into a single thing to sell to a store. For instance, while another company manufactures batteries, business might produce television remotes. The distributor can produce a more appealing, comprehensive package and increase the likelihood of sales by grouping these things together.

Strategies for Distribution Management

There are three distribution management strategies at the strategic level:

A. Mass: The mass market, such as those that sell to broad customers wherever, is the target market for the mass strategy.
B. Selective: The selective strategy intends to solely distribute to particular types of manufacturers or retail industries, such as pharmacies, hair salons, and upscale department shops.
C. Exclusive: The goal of the exclusive distribution strategy is to reach a very small audience. For instance, only authorized Ford dealerships can purchase Ford vehicles, and only a small number of luxury goods stores can purchase Gucci-branded products.

Distribution management strategy's benefits:

1. There are several reasons for a corporation to include distribution strategy in supply chain management of their organization, aside from increasing revenues. It first keeps things in order. Retailers would be compelled to store inventory at their own locations if a competent management system wasn't in place, which is a horrible idea, especially if the seller doesn't have adequate storage space.

2. For the consumer, a distribution management system also simplifies things. They can access a single location or website to purchase a wide range of goods. Customers would need to visit many sites only to receive what they need if the system didn't exist.
3. Putting in place a suitable distribution management system also reduces the possibility of delivery problems and the times when products need to be delivered.

Selling product while ensuring that there are enough supplies are available in every channel, as well as handling promotions in those channels and their various requirements, is the essence of effective distribution management. In order to maximize profit and support marketing plan, it's also important to make sure that supply chain is effective enough to lower distribution costs.

Distribution Management's Function within Supply Chain Management: Supply and demand must be balanced, which calls for supply chain distribution. Distribution plan should be able to adapt to changes in the market, such as disruptions in the supply chain and an increase in demand. Reducing the number of interactions required to move a product from supplier to customer is the goal of the distribution chain.

This study examines how the oil and gas distribution industry's planning, execution, coordination, and collaboration processes are affected by sustainable supply chain management techniques, such as supplier selection, product stewardship, and logistics management. We conducted the research on 79 oil and gas distribution businesses from Romania and the Republic of Moldova using multiple regression analysis. We came to the conclusion that Sustainable Supply Chain Management techniques significantly and positively affect all of the functions of Supply Chain Management taken into account in the research. Overall, the study's findings can be applied by oil and gas distribution companies to develop sustainable supply chain management strategies that will better meet the demands for more socially and environmentally responsible activities in their supply chains and to optimize their supply chain management to better meet those demands and expectation[4].

The goal of this study is to investigate how supply chain performance is affected by supply chain management strategy and practices. The primary tool for gathering data was a questionnaire, which was distributed to a sample of 200 managers in the manufacturing sector of Malaysia. Respondents were categorized by their job functions, which included corporate executive, purchasing, manufacturing/production, distribution/logistic, SCM, transportation, material, and operation. While only 51% of the surveys were usable, 62% of them were answered. Convenience sampling was used to choose the samples[5]. The mean, standard deviation, and correlation between the independent and dependent variables were used to examine the data. Multiple regressions, reliability and validity tests, and other statistical techniques were used in the studies. The results demonstrated a strong statistical correlation between supply chain performance and supply chain management strategies. However, the effectiveness of supply chain management is only somewhat predicted by supply chain management strategy. Manufacturing companies, supply chain management strategy, supply chain management techniques, and performance.

The paper's goal is to investigate how big data supply chain analytics affect supply chain efficiency. Second, the research investigates the contribution of supply chain integration to the relationship between supply chain performance and big data supply chain analytics. 166 professionals who work for oil and gas marketing businesses provided the data. Through expert sampling, a subset of purposive sampling, the experts were chosen[6]. To estimate the modelled relationships, we used structural equation modelling with covariance. The outcomes of the measurement model demonstrated the accuracy, efficacy, and suitability of the measurement models. The study's conclusions showed that big data supply chain analytics had a strong direct influence on the supply chain's five main aspects, namely plan, supplier management, procurement management, manufacture, and inventory management. However, the data did not indicate that BDSCA had any impact on transportation management. Findings also showed that the adoption of BDSCA may significantly enhance the supply chain's distribution and network designing components. The study comes to the conclusion that, despite the sea-potential of BDSCA in the field of supply chain management, research in this area is still in its early stages. First and foremost, academics and practitioners need to pay urgent attention to research projects seeking to determine the degree of BDSCA orientation and its implementation approach.

Many businesses have adopted flexible tactics in response to extremely unpredictable and uncertain circumstances, and flexibility has been the subject of much management study. The goal of this essay is to analyses the concept of distribution flexibility and how organizations choose among several distribution flexibility techniques. Distribution flexibility is the element of flexibility associated to a downstream supply chain. Design/methodology/approach: In this research, four Chinese firms from various industries—pharmaceuticals, solid/liquid separation, electric appliances, and clothing—are examined in an exploratory multiple case study[7]. The findings demonstrate that, depending on the situation, businesses may opt for a distribution flexibility strategy that matches their environment in the sense of contingency theory, whether it be one that focuses on physical distribution flexibility, demand management flexibility, coordination flexibility, or distribution flexibility co-alignment. They also adapt a specific distribution flexibility method for implementation to their distribution networks and distribution performance results in terms of gestalts or covariance. The sample of businesses in this study is not statistically significant, which limits the generalizability of the findings and raises questions about the objectivity of the research. Originality/value: By empirically examining the dimensions of distribution flexibility, taking into account how an organisation develops a distribution flexibility strategy in order to adapt to a particular environment, and suggesting that various distribution flexibility strategies may result in various performance outcomes, the paper adds to the body of existing literature. Publishing Company Emerald Group.

Supply chain management is becoming increasingly crucial in both the economic and social spheres. Currently, while developing governmental plans and programmes, it is necessary to take social sustainability into account. This research paper's goal was to demonstrate through a case study how to use mathematical models that take into account transportation distance, ideal locations, and vehicle routing through various clusters to optimise food distribution and delivery logistics in a social assistance programme for school breakfast. Different clustering techniques are given with the aim of discovering the common qualities in the examined population while at

the same time lowering the distribution complexity by leveraging qualitative factors such as poverty levels, food insecurity, and social exclusion. The results provide a practical method for creating a supply chain that takes into account social and economic issues. The novel model created in this study may be used to organise government social assistance programmes, to identify the unique requirements and features of the beneficiaries, and to reduce the overall cost of the logistics of the distribution network when providing food for school meals.

When designing supply chain networks, it's crucial to take into account how a firm's distribution strategy, market share, and distribution costs interact. Existing distribution system design approaches, which presume that demand is constant regardless of the firm's distribution strategy, typically disregard these interactions. This study presents a multidisciplinary paradigm for designing "profit maximising" distribution networks that takes into account these relationships. The framework uses two main decision-support methodologies: a mixed-integer programming (MIP) model for determining the best distribution network designs, and binary logit models for estimating market share while taking into account various demand-influencing factors like product price and distribution service. We used the framework to solve a real design issue for a major industrial chemical distributor[8]. The test results attest to the framework's capacity to operate on a wide scale and to the potential value of the integrated solution technique.

This essay examines a number of logistics and supply chain management-related topics, including the advantages of supply chain management and a comprehensive logistics model. It also lists a number of difficulties with supply chain and logistics management. The development of contemporary supply chain and logistics operations has been seen as being enabled by technology. However, recent developments in culture and business, including social media, mobile computing, and internet commerce, have profoundly altered almost every aspect of the logistics and supply chain environment[9]. It focuses in particular on the logistics and supply chain model used by computer and video game producer ISOFT Australia. By conducting interviews, making observations, and compiling internal company records, it highlights some potential issues Ubisoft Australia may have with its software system, communication, and information flow in relation to inbound logistics, non-conforming returns, and, in some cases, the company itself. Eventually, many suggestions for more adjustments are being offered. Supply chains are being used inside a company to support commercial initiatives. Many businesses see their supply chain as a vital business strategy rather than a cost centre. Distribution networks go from centralised to dispersed to hybrid. Businesses now use several modes of transportation and logistics rather than just one. Nevertheless, more companies are sending goods directly to consumers in addition to channel distribution.

DISCUSSION

The process of managing the flow of products from supplier to manufacturer to wholesaler or retailer to ultimate customer is known as distribution management. The administration of raw product vendors, packaging, warehousing, inventory, supply chain, logistics, and sometimes even block chain are just a few of the activities and procedures that are involved. Distribution management is primarily concerned with planning every step necessary to get items to the consumer on time and with the least amount of waste possible. As a result, it directly affects

profitability. A linked system of transportation and storage facilities is known as a distribution network. It is created in line with a distribution plan intended to convey products from manufacturers to wholesalers, retailers, or customers.

Distribution management not only increases profitability but also reduces waste in a variety of ways, from less spoilage to lower storage expenses since items and supplies may be distributed as required ("just in time" inventory) rather than held in larger quantity ("just in case" inventory). Distribution management facilitates "one stop shopping" and other conveniences and benefits, such customer loyalty reward programs, and reduces shipping costs and expedites delivery to consumers. It also makes things simpler for purchasers. Diverse interruptions might cause distribution problems. Severe weather conditions, a lack of raw materials (such as poor crop years), insect damage, and epidemics or pandemics are examples of natural disruptions. Riots, demonstrations, battles, and strikes are examples of human disturbances.

Flight delays, maintenance issues, accidents involving transport vehicles, and new or stringent transportation rules, such as those often seen in trucking, are all examples of disruptions in the transportation system. Recessions, depressions, abrupt changes in consumer or market demand, additions to or changes in fees or compliance costs, fluctuating currency exchange rates, and payment problems are all examples of economic obstacles. Product recalls, packaging problems, and quality control problems are examples of product interruptions. Order modifications, address changes for shipments, and product returns are all examples of customer interruptions. Direct and indirect distribution tactics are the two basic categories. Intensive, selective, and exclusive distribution are other more complex distribution models that fit into these categories. But what precisely do these techniques involve? So that you can decide which of these cutting-edge distribution tactics is ideal for your core clientele, let's look at some of the aspects that go into each of them.

Distribution Direct: Manufacturers that use the direct distribution technique distribute their goods straight to customers. This approach may be put into practise in a few different ways. Some businesses could decide to adopt a more contemporary strategy and utilise an online storefront where customers can make purchases. This is a good choice for businesses whose customer base is loyal to a particular brand, requires a specific solution to address requirements, or is only somewhat tech-savvy. Catalogs and phone orders are two other direct distribution techniques. This option may be aimed towards elderly clientele or clients in certain sectors who are used to submitting orders in this manner. The quantity of investment necessary is a crucial aspect to take into account when putting a direct distribution plan into practise. For instance, in order to properly distribute items on their own, manufacturers will need to add warehouses, cars, and delivery personnel to their portfolio.

Using Indirect Distribution: Although the name "middleman" sometimes has a negative connotation, these businesses may be useful in the delivery of products to customers. Indirect distribution schemes use middlemen to help with logistics and product placement so that goods may be delivered to clients quickly and in the best possible location depending on their needs and preferences. Later in this post, we will go through the many intermediary kinds and their unique advantages, but in general, employing this approach is driven by company requirements,

target clientele, and the nature of the product. Customers often make casual, low-commitment purchases at department stores without having any particular brand allegiance. A typical purchase might be a tube of toothpaste. A company's best hope for these kinds of goods may be an indirect distribution strategy that distributes a substantial number of items across several retail outlets.

Distributive Intensive: The intense distribution approach places products in as many retail locations as feasible. Gum is one item that often employs this technique. Gum is available at vending machines, grocery shops, petrol stations, and retail stores like Target. The success of this strategy depends on making a lot of products accessible in lots of places. These things often don't need a complex buying choice where the buyer does research prior to purchasing. Instead, they are commonplace purchases that need almost any work to make a profit[10].

Special Distribution: When a producer chooses exclusive distribution, they agree to sell a product solely via that particular storefront. Another instance of exclusive distribution is when companies offer products directly via their own branded storefronts. Customers must visit a Lamborghini dealership to acquire new premium automobiles, for instance, since they cannot be purchased anywhere else. The earlier agreement that Apple had with AT&T for the sale of iPhones is an example of an exclusive distribution arrangement where a producer and a retailer paired together. People gave up their phone agreements with other carriers as a result of this deal in order to get this exclusive good. This distribution technique performs best when used to highly sought-after, unique goods.

Discretionary Distribution: A compromise between intense and exclusive distribution is selective distribution. Products are delivered with this technique at a number of locations, however not as many as with an intense distribution plan. Clothing from several companies, for instance, may be supplied in a chosen manner. Instead of putting its products in a variety of retailers like Walmart or Target, a company like Gucci may decide to distribute its goods to its own stores and a few carefully chosen department stores. This may increase the likelihood that customers will buy one of the company's items while also assisting in the creation of an implicit high-end brand message.

The following factors may be used to distinguish between the supply chain and marketing channels: Marketing channels are smaller than the supply chain. It starts with raw materials and goes into great detail on manufacturing procedures and inventory control. In order to optimize value, marketing channels are focused on bringing together the partners who can offer the ideal marketing mix to the client most effectively. Within the supply chain, marketing channels provide a more focused area of attention.

Marketing channels are only directed at consumers: In order to maximize the flow of goods, supply chain management incorporates a variety of internally oriented financial and efficiency goals. Marketing channels put a high emphasis on a market perspective of consumer expectations and market competition.

The marketing mix includes marketing outlets: Delivering things is a specialty of supply chain experts. Along with product, pricing, and promotion, distribution is one component of the

marketing mix, according to marketers. The best delivery partner will most likely be found via supply chain management. The likelihood of a marketer weighing the benefits of a channel partner versus the value provided to the consumer is higher. It can make sense, for instance, to maintain a channel partner who is less effective but offers significant advantages in promotional strategy. Collaboration between the supply chain and marketing departments is a hallmark of successful businesses. The supply chain team is better equipped to improve the distribution process when they are aware of market dynamics and the potential for product and price flexibility. Greater value is provided to consumers when marketing benefits from excellent supply chain management, which involves monitoring and optimizing distribution both within and outside of marketing channels.

Over the last ten years, supply chain has grown in importance for every firm. In order to ensure their efficient operation and the flow of inputs and outputs, individual firms and organizations must now collaborate in supply chains, networks of other companies, and intricate interactions with one another. Supply chain management is the term used to describe the control of several interactions along the supply chain (SCM). SCM is an evolution of what companies formerly referred to as logistics, and it covers both the activities of logistics as well as the interactions that exist between those functions and enterprises beyond the firm's borders in his landmark book Competitive Strategy, emphasizes the significance of logistics and supply chain management as two of a company's fundamental functions and as one of the primary factors boosting profitability.

The food business is also affected in the same way. Food supply chains must contend with a rising demand for high-quality goods, which raises the need for logistical services as the quantity of items reaching end users climbs steadily. Additionally, to maintain a competitive edge in the increasingly globalized economic world, costs must be kept as low as feasible or even decreased. As if things weren't already difficult enough, additional concerns have emerged about the engagement of stakeholders in matters including food safety, environmental protection, animal welfare, and sustainable logistics methods. Therefore, the complexity and cost effectiveness of the logistical operations are the main issue and difficulty that must be solved in order to construct a food SCM effectively. Although it is significant regarding both the appropriate theoretical framework for research and the practical application, there is still a lot of disagreement. This essay examines supply chain management from both an academic and practical standpoint by outlining the system's goals, purpose, and customer service provider segment objectives. Additionally, it examines the use cases for logistics management, the structure of the supply chain, supply, and physical distribution, as well as the significance of transportation, post-sale services, product distribution, and the techniques used to gauge the effectiveness of SCM.

There is no question that all industries recognize the SCM's aims and ambitions. Deliver the proper goods or services to your clients at the proper time, location, and cost to your business. From a marketing perspective, SCM's goals are similar to those of marketing since it strives to provide the right quantity, quality, timing, and location at the lowest cost by employing all of the available corporate resources. Reduced expenses for providing a certain sector with the requisite quality of customer service is one of SCM's main goals. The second main goal is to enhance

customer service by making more goods available and speeding up the order cycle. It follows that the primary aims and goals in the area of SCM and logistics have remained constant despite the growth of academic study and corporate practice.

Clearly and comprehensively describe the participants in a firm's supply chain. Identify and remove the roadblocks/bottlenecks that impede the smooth movement of data, products, services, and money along the supply chain. Establish the appropriate procedures to ensure that the appropriate goods or services are provided at the appropriate time, location, and cost. Assign the proper individuals to do the aforementioned responsibilities. Evaluating the effectiveness of supply chain management's costs today, it is becoming more common to apply the current, process-based cost estimation approaches. The widespread use of ERP and information systems has made it simpler to conduct a precise cost analysis of businesses' operations and activities. The Activity Based Cost (ABC) technique must be used more often in light of the present state of corporate operations. ABC differs from conventional techniques of cost estimation since it: Computes network efficiency ratios simultaneously and compares them to the appropriate ideal ratios for each branch. Aids in decision-making by interfering with activity execution within the parameters of budget compliance and cost-benefit analysis calculation. In terms of both the goods and the clients, there is a greater degree of cost efficiency with less arbitrary behavior. Two ideas serve as the foundation for activity-based costing. The first is that the A.B.C. System strives to accurately display the cost-generating activities within the context of executing distributional functions throughout the supply chain. The second principle is that the demand for activities is created by the goods or the consumers, i.e., the things or sources of cost, and that their execution completes the distribution process.

CONCLUSION

To balance your supply and demand, you need a supply chain distribution system. Your distribution plan should be able to adapt to market changes, such as a decline in supply or an increase in demand. The goal of the supply chain is to minimize the number of transactions required to get a product from the supplier to the consumer. Many different distribution techniques, strategies for managing distribution, and advantages of distribution management strategies.

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CHAPTER 6

SOURCING STRATEGY IN SUPPLY CHAIN MANAGEMENT

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Abstract:

A procurement procedure known as "strategic sourcing" integrates data gathering, expenditure analysis, market research, negotiation, and contracting. It ends before the products and services are actually purchased and paid for. In this chapter discuss the Single-sourcing benefits, single-sourcing drawbacks, and multiple-sourcing drawbacks.

Keywords:

Market, Product, Sourcing, Sourcing Strategy, Supply Chain Management

INTRODUCTION

A company's purchasing operations are regularly improved and reevaluated through the institutional procurement process known as strategic sourcing. It is frequently seen as a part of supply chain management in a production context. A strategic sourcing process entails the following steps: an evaluation of current spending by a corporation, evaluation of the supply market, analysis of total costs, choosing appropriate suppliers, creating a sourcing strategy, talks with suppliers, introduction of new supply arrangements, monitor outcomes and reopen the evaluation, discuss the payment terms of the particular organization with the vendor.When a business chooses to outsource, it usually hopes to accomplish one or more of the following: greater cost savings, value for the money, higher standards of service, availability of best practices, enhanced innovation a company may choose single sourcing or multiple sourcing based on the aforementioned considerations.

Single sourcing: In single sourcing, the client selects a single supplier to offer the full range of services it wants to outsource and depends on one supplier to be in charge of the outsourced services for the duration of the contract. The following characteristics are usually present in a single sourcing arrangement:

Responsibility: The main distinction between a single sourcing and a multi-sourcing relationship is that, even in cases where the supplier has subcontracted, the customer can still view the supplier as a single point of failure for the supply of services.

Long-term contract: Single sourcing agreements have often been prolonged engagements, sometimes lasting up to 15 years. But in recent years, single-sourced deals have become shorter in length, with the majority of their original terms falling between three and seven years. As

might be expected, suppliers look for long-term contracts because they provide them more power to gradually give their clients cost savings and value for money.

Lock-in: A common issue with single sourcing is that the customer may become "locked-in" to its supplier. The supplier controls its subcontractors and is frequently more concerned with preserving its own margins, which can be disadvantageous. As a result, clients frequently struggle to foster any feeling of competitiveness surrounding the awarding of new services in a single sourcing.

Advantages of single sourcing: This lowers expenses and makes it possible to meet any additional demand that arises above and beyond the norm.Suppliers frequently provide volume discounts to customers.Enhanced cooperation and communication between buyers and suppliersA faster learning curve indicates that the supplier gets better at making the component it is supplying, which cuts down on the amount of time it takes to produce one unit.

Disadvantages of single sourcing: Single-point supplier failure might stop the buyer's entire output, which is one of the disadvantages of single sourcing.Because it is the sole provider and no other supplier is able to provide the needed component, the supplier may raise prices.If everyone cuts back on their suppliers, there will eventually be fewer providers and less competition, which is bad for the market because it leads to monopolies.

Multi-sourcing: In multi-sourcing, the customer signs separate, concurrent contracts with various vendors for various portions of the services that will be outsourced.In general, a multi-sourcing structure includes the following characteristics:

Choice and adaptability: Multi sourcing, as opposed to single sourcing, incorporates supplier rivalry and prevents long-term reliance on a single provider for a variety of services.

Responsibility. Due to the fact that the client assigns responsibility to multiple providers, the operational risk is larger than in a single sourcing scenario. It may be more difficult to reach an agreement and make sure that the various contracts are carried out properly as a result of this engagement with many parties.

Benefits of using numerous suppliers: Costs will decrease due to competition**.** Supply won't be interrupted if a problem arises with one supplier**.** Buyers may have more negotiating leverage

Drawbacks of multiple sourcing include: Managing more suppliers**.** A slower learning curve**.** Orders dispersed across numerous vendors may not qualify for quantity discounts.

Cross-Sourcing: It's not necessary for single sourcing and numerous sourcing to be mutually exclusive. Cross-sourcing, a hybrid strategy, is one option. Without actually expanding the number of providers, dross sourcing broadens the supplier base.

In a three-tier supply chain made up of a major final assembler (FA), a first-tier supplier (S1), and a second-tier supplier, this research examines the financial leveraging impact of a final assembler's sourcing strategy (S2). We take into account two sourcing and four finance techniques from the viewpoint of FA. The two sourcing techniques include either directly purchasing from S2 or assigning the task of component procurement to S1 (sequential sourcing)

(directed sourcing). Commercial loan financing, factoring, and reverse factoring with or without a payment term extension are the four financing techniques. Our major goal is to identify the optimal sourcing and finance strategy combination, along with the related factors, that would lead to better operational choices and improve supply chain performance as a whole. The results show the situations in which directed sourcing or sequential sourcing could be successful. For instance, FA, S2, and the supply chain are better off with directed sourcing when S2 is strong or when S2's influence is modest but the interest rate is high. This is true when the suppliers use factoring as a financing option. Otherwise, sequential sourcing ensures that FA, S2, and the supply chain will make more money. Reverse factoring produces more predictable performance that may be used for the FA's advantage with a payment term extension or for the long-term health of the supply chain without a payment term extension [1]. The primary focus of the research was on how single sourcing approach affected Malawi's public healthcare delivery supply chain, either by aggravating or by reducing recurring supply failure. It also looked at how the nation's public hospitals often experience medicine shortages due to a single supplier. In southern Malawi, five public healthcare delivery facilities were used for the research.

Two sets of self-administered questionnaires were given to hospital management and procurement personnel at participating institutions in order to gather data. To supplement the information from the surveys, follow-up interviews with a sample of randomly chosen managers were also planned. The study's results supported the notion that single sourcing increases the likelihood of supply failure, as shown by the ongoing medicine shortages in hospitals that endanger the lives of many people who depend on the public healthcare system. Such stockouts have a variety of negative repercussions on the public healthcare delivery supply chains, including patient deaths, health problems that worsened, hospital congestion, and patient transfers to other institutions (mostly private). The primary reason of stockouts was determined to be the government's only supplier, the Central Medical Stores, who failed to keep an acceptable inventory of medications in terms of both amount and diversity. Since the single source method increased the likelihood of supply failure, the research has revealed that it is often unsuitable for healthcare delivery systems. These results are supposed to assist policy makers in developing the best procurement methods and policies to improve healthcare delivery [2]. It is clear from the extensive literature on sustainable supply chain management (SSCM) that the social component has been overlooked and that the importance of sourcing intermediaries in supply chains has not been adequately highlighted. The length and complexity of the garment supply chain have greatly risen, forcing apparel retailers to use sourcing intermediates to handle their sourcing operations with suppliers in developing nations abroad. By investigating the management of social sustainability when sourcing intermediaries are placed between the focal firm and the corresponding developing country manufacturers, this research hopes to add to the body of knowledge already available on SSCM. This research primarily intends to comprehend the function of intermediates in the clothing supply chain in the execution of social management methods based on the opinion of various supply chain participants. Semi-structured interviews were done in Vietnam and Europe to gather qualitative data. In the end, eleven suggestions are made, all of which specifically highlight the clothing intermediary's function as a key facilitator of social sustainability in garment supply chains. A social risk manager, a supplier developer and coordinator, a gatekeeper and safeguard, a cultural broker, and a social risk manager are the

positions. Both clothing retailers and manufacturers in developing countries benefit greatly from the social sustainability responsibilities that the intermediate in the garment sourcing process assumes. While businesses understand the value of using suppliers to achieve sustainable supply chain management objectives, many find it challenging to put environmental policy into practise.

This study examines how organisations may utilise strategic goals, particularly environmental strategic emphasis and environmental sourcing processes, as levers to improve environmental supplier cooperation by using ideas from social exchange theory. Results show that the relational norms inherent in cooperation are connected with interorganizational citizenship behaviour, a relational outcome with a forward-looking perspective, using structural equation modelling to evaluate primary data from supply chain professionals in the United States. The study also looks at how environmental regulatory pressure affects the linkages between the causes and effects of supplier cooperation in the environmental sector[3]–[5]. Regulatory pressure is less successful at encouraging supplier cooperation when companies have made environmental sourcing practises a strategic objective. Finally, regulatory pressure is more likely to cause companies with relational standards for environmental supplier partnership to act in an interorganizational citizenship manner. This research intends to conceptually hypothesise and empirically analyse the links between supply chain resilience, mitigation methods, and global supply chain hazards. Design/methodology/approach: In order to handle supply chain risk in sourcing, production, and delivery, the research embraces supply chain resilience as a dynamic capacity and resilience capability as a mediating precondition. To improve supply chain resilience, several mitigation measures are explored for their moderating effects. Survey data were utilised for structural equation modelling and other testing to investigate the best mitigation tactics for various risk settings. Findings: While the effectiveness of seven mitigation techniques depends on the linkages between supply chain risks and resilience, improving supply chain resilience competence has a significant mediating function. Research constraints and consequences The results show a role for supply chain resilience capabilities in the theoretical evolution of risk management challenges in international supply networks. Practical implications: The results provide management advice on how to reduce the risk associated with the global supply chain by putting measures to increase supply chain resilience in an uncertain environment into proper practise. Originality/value: This is the first empirical study to look at how mitigation techniques affect the resilience of the supply chain. The findings give theoretical guidance for next supply chain resilience research as well as practical implications for handling unpredictable situations[6]–[8].

The management of social concerns via life cycle management (LCM) and sustainable supply chain management (SSCM) is how responsible metal sourcing is defined[9]. The supply of "conflict minerals" such as tin, tantalum, tungsten, and gold (3TG), whose extraction and trading are linked to violence and harsh socioeconomic circumstances in the Democratic Republic of the Congo, is the main topic of discussion (DRC). In order to purchase these metals from miners, smelters, and refineries that provide conflict-free sources, downstream firms are using compliance tactics to reach several layers and great distances within supply chains. Methods: The study compares 16 conflict mineral initiatives using qualitative research methodologies and open-source materials. The investigation of programme governance, programme standards, and

certification procedures was led by a theoretical framework in three aspects. Confidential access to audit reports, corporate policies, and management practises on more than 140 metallurgical facilities provided further empirical study of the conflict-free sourcing programme, the biggest and most important industry-led initiative on conflict minerals. Conclusions and discussion Pricing and major producer compliance show how conflict-free sourcing initiatives have changed global 3TG metal supply chains in less than 4 years. Electronics, jewellery, and other industries are "pushing" metals markets for conflict-free sourcing, with the help of US conflict mineral legislation in many cases. To facilitate effective involvement, private standard initiatives concentrate on product chain chokepoints, influencing a small number of 3TG facilities to build "responsibility management systems," participate in conflict-free sourcing, and undertake compliance audits. Some supply chains run as closed pipelines from the mining to the finished product. Tantalum has had the most success since roughly 95% of producers comply; nevertheless, the level of compliance is problematic for gold in particular. Conclusions: The management procedures of upstream raw material producers are "governed at a distance" by downstream manufacturing businesses. Responsible sourcing for LCM can be relevant to supply chains that include other metals and commodities. Conflict-free sourcing for SSCM shows how supplier development and compliance initiatives may reach several levels of supply chains to solve social challenges in developing nations. Future studies are required to better understand supplier firms, their motives, and sustainability performance results in relation to the conflict mineral issue.

This article explains the connection between supply chain resilience difficulties and proactive management techniques, in particular because of global sourcing (GS) policies. The following are this paper's primary goals: In addition to reporting the trends and implications discussed in the literature, this study aims to I explain the various aspects of GS, (ii) view GS through the lens of complexity theory, and (iii) examine the resilience of the supply chain as a result of GS complexity and offer solutions to its challenges. In order to analyse the effects of GS complexity variables on supply chain resilience with regard to three outcomes—risk and innovation, benefit in terms of sales promotion, and difficulties and responsiveness—we present a framework for GS resilience. This introduction summarises the articles in this special issue based on the framework. Researchers and practitioners might use this material to learn more about how complexity and proactive management techniques affect GS resilience[10].

DISCUSSION

One of the most important components of doing company is supply chain management. Because the average consumer often only perceives its impacts, many persons outside of the immediate community are unaware of this. Remember how many times you got a great "deal" at the end of the season, remember the sudden increases in gas prices due to shortages, remember the instances when your e-commerce site promised availability but later could not deliver the required product or sent you the wrong product, or remember the instances when your customized product. Consumers often encounter the aforementioned events, as well as a number of others, as a direct result of the supply chain management strategies used by businesses. Supply

chain management techniques have an instantaneous influence on business-to-business interactions, unlike business-to-consumer transactions.

Due to problems with its heavily outsourced supply chain for the Dreamliner 787 in the late 2000s, Boeing encountered a significant delay in introducing the new aircraft and had to pay more than $2 billion in support and expedited component supply costs. 2011 saw the first Dreamliner 787 delivered, and less than two years later, quality problems with the batteries forced Boeing to stop manufacturing the aircraft. Tens of millions of toys produced in China had to be recalled by Mattel in 2007, and this incident serves as the quintessential example of the problems with imports' perceived quality.In order for a company to leverage its combined buying power to discover the lowest prices in the market and match its purchasing strategy with business objectives, strategic sourcing formalises the information gathering and usage process. As supply chain and procurement procedures change as a result of digital transformation, strategic sourcing is becoming more and more common. Analyzing what an organisation purchases, from whom, at what cost, and in what quantity is necessary. Strategic sourcing varies from traditional buying in that it optimises the sourcing process by continual market study and connections with suppliers, placing emphasis on total cost of ownership in addition to the original purchase price.

Implementing strategic sourcing

Strategic sourcing may help businesses' procurement procedures become less opportunistic and price-driven. Instead, a sourcing strategy may help them create a flexible structure that enhances the long-term worth of the company. The selection of a supplier roster is based on data collected during data collection and market research, which is the first step in the process after examining company requirements and historical expenditure. After negotiations and selection are complete, strategic sourcing also include performance monitoring and ongoing process improvement. Large companies with plenty of suppliers often engage in strategic sourcing. For businesses that want to outsource strategic sourcing to a professional, there are outsourcing companies.

The most apparent benefit of strategic sourcing is lower overall costs, but there are several more advantages to rethinking the sourcing process. Procurement is an area that is ready for transformation as firms take use of the enormous quantities of data that are accessible and the digitalization of business operations. The primary justification for purchasing a strategic sourcing suite, at 74%, is to alter sourcing inside the company, according to Gartner's Magic Quadrant for Strategic Sourcing Application Suites. Businesses cited higher savings (61%) and efficiency via automation (65%) as their main motivations for using strategic sourcing.

Having a better grasp of supplier marketplaces may make it easier to spot possible risk factors and assist companies in creating sourcing strategies that reduce them. Additionally, the supply chain's focus on sustainability and continual development gives it more flexibility and the capacity to adjust to outside variables. Longer term, strategic sourcing may help establish trusting relationships with vendors and outsourcers, identify areas for improvement, and justify adjustments to boost productivity throughout the supply chain.

Examples: A strategic sourcing strategy may aid companies in achieving a variety of successful objectives. Several examples are as follows: competitive differentiation through the use of

suppliers with desired brand images and emphasizing them through marketing, such as the Intel Inside logo, compliance or regulatory guidelines by choosing certified components, supporting business sustainability by choosing Fair Trade or other sustainably grow

The variety of actions and processes required for firms to obtain goods and services is referred to as procurement. Although this theoretically entails both strategic and administrative duties, procurement departments often concentrate on the routine e-procurement operations and transactions, such as purchase orders, invoicing, and payments. Strategic sourcing, on the other hand, places more emphasis on the actions taken prior to making a purchase, such as researching the market and your company's requirements. In contrast to procurement, which often seeks for the lowest-priced alternative, strategic sourcing considers the larger picture and uses extensive data sets to assess the importance of other criteria like ideal vendor relationships and decreased business risk.

By unifying sourcing standards and offering a platform for gathering data about suppliers, goods, markets, and business needs, strategic sourcing software may help the approach. Larger procurement systems, procure-to-pay platforms, ERP systems, and supply chain management systems may sometimes include this software. However, "strategic sourcing application suites" are becoming more and more well-liked products. These often have various software modules and generally contain features for e-sourcing, expenditure analysis, contract administration, and supplier relationship management. Gartner lists Coupa, GEP, Ivalua, JAGGAER, SAP, Synertrade, and Zycus as major companies. Although some companies also provide on-premises or private cloud versions, multitenant SaaS is the main delivery method for their goods. Vendors are attempting to use AI and advanced analytics to improve the efficiency of the sourcing process. These capabilities may give prediction models based on variables including market circumstances, the season, and geopolitical considerations, as well as suggestions based on historical performance and current measurements. In other circumstances, the supply chain's use of block chain is also improving visibility and accuracy.

Only five candidates will be interviewed, and only one will be hired, for every 300 or more applications. There is a sea of indifferent and uninvested applicants as a consequence of rising unemployment rates and rising passive application rates. Using the finest recruiting sourcing techniques is essential to finding excellent personnel.

Six recruitment sourcing strategies: It's crucial to understand that sourcing and recruiting are two distinct processes. Just as vendor management is a component of procurement, so is sourcing—more particularly, the initial step of recruiting. Finding applicants to fill open roles or prospective future opportunities is known as sourcing. This initial phase requires detailed understanding of the duties of the job, the precise metrics or qualities to consider, and the best ways to find top personnel. This manual provides several examples of sourcing strategies to hire the top talent in your field.

1. Credible referrals: This tried-and-true method seems simple enough. When it comes to recruiting, HR professionals are aware of the value of professional networks. A 2020 Referral Statistics Report by LinkedIn found that recommended applicants are four times more likely to

be employed and that 45% of these referred workers remain with the organisation for four years or longer, resulting in a greater return on time invested. Utilizing personal relationships helps recruiters save time, effort, and money.

2. Examine previous applicants: A chance is presented by the runners-up who only missed out on a prior place. It could be appropriate at this point to fulfil your promise to the prospect that you would keep them in mind for future chances. You have already conducted an interview with them, evaluated their credentials, and determined that they are a close fit. You are effectively going three steps ahead by starting with candidates who have already been interviewed.

3. Understand Your Touch points: To source candidates, the marketing rule of three also applies. Create three touch points over the course of a month when communicating with prospects through cold emailing or messaging to encourage engagement. The prospect is more likely to apply for a job if they have a connection with the recruiter and the organization, and the recruiter is better able to assess the candidate's personality and capabilities.

4. Expand Your Search for Talent Acquisition: Instead of relying just on one source of supply, it is crucial to nurture a variety of them. One must go from the usual route in order to find the jewels concealed in the rough. Not every candidate routinely checks LinkedIn. Most likely using a passive application method, job seekers on LinkedIn click "Easy Apply" on each opportunity that appears in their search results or recommended ads. Increase the scope of your search by include profession-specific sites like Godthab for coders or Behance for graphic artists. Keeping a database of open positions within the organization is another strategy for diversity. Although LinkedIn accommodates passive candidates, those that apply directly via the business website are more engaged. Visit college campuses that conduct department-specific recruiting events if you're looking for entry-level jobs. This candidate pool is well-versed in the most recent methodologies and research, aspirational, willing to work, and trying to establish themselves.

5. Avoid depending on resume keywords: The use of keywords may have been a useful way to locate the necessary certifications fast. A resume writing service is used by 10% of candidates, according to several recruitment intelligence websites. Writing services for resumes include keywords into their clients' documents so that they would rank well on applicant tracking systems (ATS). In other words, your "top applicants" may not really be those who are most qualified for the position but rather those who offered the most salary. It's not a good idea to rely only on an ATS. Create an ideal applicant persona and analyse who is the most qualified for a job by looking at resumes, LinkedIn profiles, and social media.

6. Internal Hire: Providing workers with upward mobility while filling vacancies with competent individuals is simple with up-skilling. Analyze the skill sets of your present employees to see where they would be most useful or how they may be trained for a new position.

Many businesses or employment agencies have their own candidate database. Hiring managers search the database for possible applicants whenever there is a need for new hires. To discover qualified applicants, they could make use of an application tracking system (ATS). Candidate relationship management solutions may help recruiting managers narrow down the pool of prospects who have already applied. All the candidate information may be gathered, stored, and

reviewed as needed. Potential applicants for different employment positions may be found on a variety of social media channels. Many hiring managers include social media into their process for finding talent. Depending on the job requirements, you may scan and identify applicants on social media channels. You may improve the organization brand by using social media channels to find applicants. On websites that focus on employment, you may post job openings and communicate with different specialists. Referral-based recruiting is another popular hiring method that many hiring managers use. Many businesses advertise a referral scheme whereby workers may be compensated with a bonus upon successfully referring a candidate. You may compel current workers to suggest qualified applicants for available positions. Employee recommendations are seen as a cost-effective strategy by many recruiting managers. You may also let current workers apply for the open positions.

Candidates may learn more about the qualifications needed for a position from the job description. You may simplify the recruiting process by making efficient job listings. You may distribute job advertisements on different web sites to draw in prospective employees. Your job posting may reach a wide audience by being posted on the appropriate site. Make sure to include all pertinent information in the job posting since doing so may help the hiring process go more smoothly. Many hiring managers believe that one of the finest places to find suitable candidates is inside the company. You may let current workers apply and have their performance evaluated. Additionally, you may transfer current employees to a different role or give them a promotion. Employees looking to shift occupations may benefit from it. Additionally, evaluating your own skill may enable you to make better use of your resources and save time. Since they can quickly adjust to the workplace and the position, many hiring managers favour employing experienced experts. Employing managers often gather and keep records of all the applicants who submitted applications for available positions. The sourcing pipeline is a technique for gathering data that enables hiring managers to identify people with necessary credentials and abilities. You may add the data to the database whenever an applicant applies for a certain position and utilise it later. Connecting with possible applicants for future positions may be facilitated by adding crucial information to the pipeline. You may better comprehend the employer's expectations and job needs by working closely with them. Make sure the criteria are accepted by both you and the company. You may schedule a meeting to learn more about the employer's objectives and vision. Before you begin interviewing individuals, think about specifying the number of vacant jobs precisely. Keep the company informed at all times about your recruitment efforts and communicate your success.

To interact with prospective employees and educate them about the company, you may develop persuasive outreach messages. To get recipients to open and read the rest of your letter, think about creating an intriguing subject line. Candidates may find it useful in understanding the demands of the position and the advantages of joining the company. Include details that are pertinent to the position. Many recruiting managers send prospective applicants follow-up emails. Follow-up emails might convey to applicants your desire in learning more about their qualifications and expertise. Even applicants with all the necessary qualifications and experience sometimes decline to apply for work-related reasons. You may send a follow-up email to them and inform them about the chance if there is a job vacancy that might be a good fit for them.

Following the recruitment process, hiring managers may monitor their KPIs. You may examine the recruiting procedure to determine which approach was more successful. Examine how many times you tried to contact prospects to gather their reply. You may modify the message in accordance with the situation and utilise it during the next recruiting season. Additionally, you may determine the area from where you received the finest applications and keep recruiting from there. When speaking with qualified applicants, respect their time and be accommodating to their schedule. When speaking with a candidate over the phone, start by asking if they have time to chat. Think carefully about stating how much time you need in order to cover all the pertinent details of the job posting. You may reach out to them at various times and in a variety of ways throughout the week. Candidates may feel more appreciated and have a favourable impression of the company as a result. In your capacity as a recruiting manager, you may also locate suitable applicants via offline sources. You may meet potential employees in person by going to job fairs. To locate qualified applicants with the required skills and expertise, many hiring managers go to conferences and job fairs. You might ask them if they are seeking for work and then follow up with an email with the job criteria.

CONCLUSION

Strategic sourcing will increase product quality and service while reducing overall procurement costs, thus strengthening a company's competitive edge. Focusing just on finding solutions to the issues of the present is no longer sufficient; the future is crucial now.This sourcing strategy describes a purchasing organization that only has one source of supply for a certain item or service. This may be as a result of the unique significance of the product or the way the supply market is set up, where there are only one or a small number of suppliers who are able or willing to provide the particular product. Single source structures often lead to mutually beneficial partnerships that are founded on long-lasting trust. Frequently, the supplier actively participates in the product development of the purchasing company, allowing for the development of both products and processes. From the standpoint of reliance, the purchasing company will be more dependent on the supplier than the other way around. This has been identified as a drawback of the single source approach.

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CHAPTER 7

TRANSPORTATION IN SUPPLY CHAIN MANAGEMENT

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Abstract: Moving products physically between sites of origin and destination is a part of transportation. In a company's supply chain, the transportation system connects locations that are spread out geographically. The development of time and place usefulness is made easier by transportation. Additionally, transportation has a significant economic influence on how well firms are doing financially. This paper discusses about the transportation in the supply chain management important transportation elements in supply chain management.

Keywords: Expenses, Supply Chain Management, System, Visibility, Transportation.

INTRODUCTION

A continuous and seamless supply requires transportation or shipment. Economic volatility, fluctuating fuel prices, customer demands, globalization, new technology, shifts in the transportation sector, and labor restrictions are all issues that affect shipment. The primary driving forces behind transportation should be taken into account because it is entirely dependent on them to fulfil orders and make sure that all flows are functioning effectively. The key components are

Long-term Decisions: Transportation planners should take into account the supply-side freight flow while designing the network configuration. Choosing the major method of transportation is a long-term choice that must be made by the transportation manager. The manager must be aware of product flows, quantity, frequency, seasonally, physical characteristics, and any requirements for special treatment. Additionally, the management must decide how much outsourcing will be done for each product. He should carefully take into account that the networks do not have to be constant while taking all of these elements into account. For instance, stock destinations can be put together through contract transportation companies in order to carry stock to regional cross dock facilities for sorting, packaging, and brokering small loads to individual clients.

Making decisions about lanes: These practical choices put a strain on regular freight operations. Here, the transportation managers collaborate on every product move that is both inbound and outbound shipping routes using real-time information on products, requirements at various system nodes, in order to meet their service demands at the lowest feasible cost. Good decision-makers are adept at handling information, taking advantage of opportunities for their personal gain, and ensuring that the product is delivered promptly, whenever it is needed, and in the appropriate quantity.Additionally, they are saving money on transportation costs at the same

time. For instance, a cargo from a New Jersey-based supplier has arrived, and during the same week, a product that is ready for shipment needs to be sent to New York. If the manager had had this information beforehand, he might have prepared everything in accordance with demand, allowing the merchandise to be shipped out right away.

Choice of Carrier and Method: Determining the best means of transportation is a crucial choice. Modes of transportation that were previously unavailable in the traditional transportation modes can now be a preferred option thanks to advancements in transportation technology.For instance, a package that is more cost-effective and efficient than a car transport may be provided by a rail container service. The management must take into account both the cost aspect, which is a crucial concern, and the service standards that must be met, such as the delivery time, date, and special handling requirements.

Operations at Dock Level: The final degree of decision-making is involved here. Planning, routing, and scheduling fall under this category.For instance, the dock-level supervisors' responsibility is to ensure that loads are placed in the sequence of the planned stops and that the driver is advised of the most efficient route while a carriage is being loaded with orders from various customers.

Warehousing: The supply chain process relies heavily on warehousing. Customers' needs and expectations are changing drastically in today's marketplace. Everything must be available at a reasonable price and delivered right to our door. We can say that managing warehousing operations necessitates a particular fusion of engineering, IT, human resources, and supply chain expertise. It is preferable to accept items in an immediately storable conveyance, such as a pallet, case, or box, in order to reduce the effectiveness of inbound functions. The kinds and numbers of processed orders are needed for identifying the structure, tool selection, and business process. Another important factor is the quantity of stock-keeping units (SKUs) at the distribution facilities. The products are guided to their proper storage area by the warehouse management system (WMS). The necessary functionality is subsequently provided in order to complete and optimize the receiving, storing, and shipping processes.

Purchasing and Sourcing: One of the most important aspects of supply chain management is sourcing and procurement. The business determines if it wants to handle all the exercises itself or hire a different independent firm to handle them. This is known as the "make vs. buy decision," which we will briefly cover in a later chapter.

Returns Management: The management that encourages the fusion of opportunities and difficulties for incoming logistics is known as returns management. A cost-effective reverse logistics program connects the supply of returns with the knowledge about the product and the demand for items that can be repaired or materials that can be reclaimed. Three pillars serve as the foundation for our returns handling procedures. These are listed below:

Speed: Quick and simple returns management is essential, as is the automation of decisions regarding whether to create return material authorizations (RMAs) and, if so, how to handle them. Labels and attachments, user profiles, and automated workflows are the main instruments for expediting return processing.

Visibility: Information must be gathered early in the process, ideally before the return is delivered to the receiving dock, to improve visibility and predictability. The most efficient and practical methods for gaining visibility are carrier integration, web-based portals, and bar-coded identifiers.

Control: Coordinating the transfer of materials is a frequent problem in return management that must be addressed. The producers must exercise extreme caution, closely monitor receipts and reconciliation, and inform the stakeholders of any upcoming quality problems. Reconciliation in this instance activates control and visibility throughout the entire company. Regulatory compliance, reconciliation, final disposition, and quality assurance are the main control points in this procedure.Software solutions can aid in accelerating the management of returns by supporting profile pages and process flows that state supply chain partners and processes, by labelling and documentary evidence that tracks the material along with the web-based portals, and by exception-based reporting to deliver information for prompt reconciliation. These traits promote a dependable and predictable returns procedure to count value across the firm when used in conjunction with the three aforementioned pillars.

Post-Sale Support: As companies offer solutions rather than items, the post-sale service in the supply chain has a tendency to become a more crucial component.The after-sales services include providing training, education, and consulting as well as selling spare parts, putting in updates, performing inspections, maintenance, and repairs. Currently, a large volume of after-sales service demonstrates to be a successful business due to the expanding demands of the clients. The services offered here are essentially heterogeneous, and the value-added services are distinct from the services offered previous to the sale.

The synchromodality construct, a revolutionary supply chain idea that incorporates the flexible utilization of several transport modes based on real-time information, is developed and tested in this research. Synchromodality has come to the forefront of study and use as a technique to assure effective delivery performance and, therefore, supply chain competitiveness at a time when global supply chains are complex and vulnerable to instability. Even if prominent businesses and decision-makers are interested in synchromodality, only researchers in the field of transport have so far taken an active interest in it. To realize synchromodality's full potential, we feel a supply chain management viewpoint is lacking yet very necessary. Our research demonstrates that the four essential components of synchromodality capabilities are visibility, integration, multi-modal transport, and flexibility. This work conceptualizes, develops, and evaluates the first synchromodality measurement model, which captures the multidimensional character of the notion, using a three-stage research process that makes use of different approaches. In doing so, we want to pave the way for a variety of possible new lines of inquiry into the use and effects of synchromodality [1]. The topic of eco-design for transportation in relation to sustainable supply chain management is covered in this paper (SSCM). A model is built for this application using an expanded version of data envelopment analysis (DEA). This suggested model may provide stakeholders a Pareto Optimal transportation plan, together with the tractable algorithm created in this study. With decreased resource use and pollutant production, this transportation plan may assist stakeholders in achieving specific transportation

objectives. The debate leads to a heuristic Joint Transportation Policy and ends with two practical recommendations for implementing the plan. The analysis further demonstrates the theoretical and practical significance of this research. The suggested model was utilised in an empirical investigation to build sustainable transportation mechanisms for one air-condition company in China to convey its goods [2].Where market shares are growing in a highly desired way, international commerce is widespread. Therefore, it is logical to assume that products are seldom consumed where they are created and that transportation services are the crucial link connecting all of the Supply Chain's components. The planning, design, control, and execution of all business activities connected to the operations of a company's production, distribution, and order fulfilment procedures are all included in supply chain management. Most forms of transportation use wheels. The functioning of logistics relies heavily on transportation. The main component of the logistics chain that connects the disparate activity is the transportation system. One-third of the expenditures associated with logistics go toward transportation, and the performance of the logistics system is significantly impacted by transportation systems. The whole production process—from manufacture through delivery to customers and returns—requires transportation. Any supply chain's management of its transportation may be used to assess its performance. Business transportation makes a significant contribution and is a competitive force. It serves as a physical link between the firm and the other supply chain participants, such as suppliers and consumers, and has a significant impact on how satisfied customers are with the brand.

The growing importance of transportation, its role in logistics, the supply chain, and other topics are the major topics of this essay [3]The peculiarities of the scheduling issue for transportation vehicles in supply chain management including third party logistics companies are examined and analyzed in this work. First, categories each transit node into one of three groups. On the basis of two unique types of transportation nodes that have combined the self-support vehicle and 3PL vehicle resource, a new partial collaborative transportation scheduling technique is provided. Then, a modified Ant Colony Optimization with Negative Selection Operation (ACO-nso) with Variable Dimension Matrix Encoding and Modified Transition Probability Operation Method has been given, depending on the transport mode of each kind of transportation node. Finally, the simulation results show that the suggested strategy is useful and effective [4]. In Malaysia, the rise of the halal business has a favorable impact on supply chain management. Throughout the supply chain process, logistics operations play a key role as one of the crucial elements. The manufacturers/suppliers, the means of transportation, the storage/warehouse, the clients/customers, and the third-party logistics (3PL), also known as the logistics service providers, are among the participants in logistics operations (LSP). This research makes an effort to examine the practical aspects of providing Halal transportation services, particularly for Malaysia's Halal food business. Monitoring Halal performance in transportation operations that need to adhere to Shariah principles is one of the factors of managing "Halal" in logistics activities, claims the Halal Industry Development Corporation (HDC, 2009). The concern is in the operational practice by industry players in understanding the knowledge and related issues pertaining to the Halal supply chain in order to stay competitive in the expanding business market. Malaysia has all the infrastructure required to support the growth of the Halal industry [5].The impact of transportation costs on supply chain management is covered in the article

(SCM). The movement of materials from suppliers to end users may be planned and controlled using an integrated technique called SCM. SCM makes an effort to jointly manage channel interactions for the gain of each link in the chain. SCM aims to achieve customer service goals while also reducing inventory and related expenses. The idea of merging functional groups inside the company has gained widespread support during the last twenty years. This idea of cooperative integration is expanded by SCM to include all businesses in the supply chain, including the buyer, supplier, and carrier. According to the study given in this article, concessions made by the customer, seller, and carrier may increase profitability for all parties. The authors initially create a generalized model and talk about some potential issues with its use. Leading management scientist Paul D. Larson has created a model that, by calculating an economic transportation amount, simultaneously identifies the best method of transportation and the lot size or shipment quantity[6], [7].

A large-scale device for industrial cement firing is the rotary kiln. This article examines the use of rotary kilns in supply chain logistics transportation because to their properties as thermal insulators. This paper's primary areas of investigation are the rotary kiln temperature simulation model and intelligent supply chain logistics transportation monitoring management. In this study, the rotary kiln and its variables are analyzed, and a thermal simulation model of the rotary kiln is created. A new type of smart supply chain logistics transportation method is then developed and designed in this article, and the rotary kiln thermal simulation model is then applied to it. The article also combines the relationship between logistics and supply chain, studies the characteristics of supply chain, and summarizes and designs a new type of supply chain logistics transportation method. This work develops the supply chain optimization experiment and the rotary kiln simulation thermal numerical optimization experiment in order to maximize its transportation efficiency and thermal insulation degree. This article also performs an overall logistics efficiency analysis based on DEA, analyses the experiment's findings, applies them to the intelligent supply chain logistics transportation method of the rotary kiln's thermal simulation model, and contrasts it with the conventional transportation method. The experimental findings demonstrate that the thermal simulation model-based intelligent supply chain transportation technique outperforms the conventional transportation method in terms of insulating effect by 5% to 9%. The smart supply chain transportation approach based on the thermal simulation model of the rotary kiln offers a 4%–8% higher transportation efficiency compared to the conventional transportation method[8], [9].

DISCUSSION

When a product is being transported, it is being moved from one place to another as it travels from the start of a supply chain to the client. This necessitates a fresh, comprehensive look at the logistics, supply chain management, and procurement aspects of the transportation supply chain industry. A significant chunk of a company's supply chain expenses come from transportation, which accounts for around 6% of GDP in the United States. You can strategically collaborate with other supply chain participants to more successfully realise the corporate and business vision your organization has set out to achieve when you think more broadly about the role of transportation in the overall supply chain and business and less narrowly about the tactics of

transportation. Modern supply chain management has allowed many manufacturers and retailers to save inventory and storage expenses while accelerating delivery to the final consumer.

The successful operation of any supply chain is directly related to the efficient utilization of transportation. Walmart has successfully reduced its total expenditures by using a flexible transportation strategy. Cross-docking, a procedure in which merchandise is transferred between trucks so that each vehicle travelling to a retail shop receives goods from various suppliers, is a technique used by Walmart at distribution facilities. The transportation plan of a company should complement its competitive strategy, according to managers. A mix of transportation expenses, additional expenditures, such as inventory influenced by transportation choices, and the degree of customer responsiveness attained should be used by businesses to assess the transportation function. To satisfy their demands, managers should take into account a suitable mix of company-owned and contracted transportation.

The Negative Effect of Underappreciating the Role of the Transportation Supply Chain. Even apparently little mistakes might result in unnecessary expenditures that could have been avoided when freight prices are high, reducing total profit margins. In cases of oversupply in the sales channels, product write-offs may happen. Unrealized sales prospects are another drawback of undersupplied sales channels. Failure to keep track of raw material pricing might also lead to expenses that are higher than average across many sources. The hidden cost of transportation in a weak supply chain is another factor, and it is arguably more harmful to budgeting. Making sure that the process of moving products from one place to another is as efficient as possible becomes a major economic issue while doing business.

This is particularly true for big businesses, and it is simple to understand how freight visibility and transportation costs are related. Transportation expenses are still a key factor in generating profitability, even in smaller enterprises with very modest margins. Although visibility of the transportation supply chain is often seen as a main objective, it is also utilized to just impress people who have invested in the organization. This is particularly true for bigger businesses. This is due to the fact that many businesses have never truly found out how to achieve true supply chain and transportation visibility. Because supply chain visibility as a process necessitates full system integration functioning amongst several aspects, it does not always get the attention it merits in the transportation industry. Some of these components need the usage of various master data. This information must run smoothly across all platforms in addition to being present. Systems for managing warehouses, several ERPs, ordering processes, and transportation are some examples. To maintain these sources cohesively linked together when they are spread over many regions, further care must be taken. The glue is responsible for moving the materials from one place to another. The objective is to do this task quickly and affordably. Without insight into the transportation supply chain, there will be delays, costs, and maybe backlogs. These occurrences have the potential to disrupt production plans, possibly leading to idle labour or potential revenue losses. So, as the expenses mount, it becomes clear why it's crucial to concentrate on comprehending transportation's function in the supply chain [10].

Transportation Supply Chain Management's Precarious Balance: Supply chain management often reduces to a simple cost-versus-time balancing exercise. The transportation component makes this the easiest to perceive. Although there are several methods to transport products, with forethought, the cost of shipping may be balanced via various procedures and contrasted against corresponding shipping timeframes. The lowest freight costs may be attained when producers prepare ahead to ensure that the goods arrive in the quickest manner possible. A lot of people prefer to imagine a business supply chain as being alive. All living things undergo constant change. Raw materials' pricing may vary, foreign currency rates may alter, and some suppliers like taking on incumbents with what seem to be superior prices or services. Any of these modifications may also have an impact on the transportation supply chain. This implies that the supply chain is dynamic, and if the supply chain is dynamic, then the needs for distribution will also vary. It is on to the shipper to put mechanisms in place, either internally or via a transportation management 3PL, to supply that knowledge. Transportation systems must alter in response.

The availability of analytics offered by a transportation management system allows for the resolution of many issues in the transportation supply chain. This is particularly true when supply chains expand and start to function on a bigger scale, necessitating the need for such insights to enable businesses to make more informed business choices. Recent technological developments also promise improved integration of physical goods movement and visibility. The proliferation of networked devices to link pallet, trailer, and container systems in order to give better visibility is an excellent example. Of course, for these excellent technologies to flourish, appropriate execution is necessary.

To increase visibility and reduce the likelihood of supply chain mistakes, businesses of all sizes must approach the transportation supply chain by putting more harmonic processes in place. This will ultimately save the business money overall, even after accounting for transportation expenses. The highest supply chain visibility always results from well implemented transportation management solutions. Performance will increase all around when transportation systems are fed into a predictive analytics plan. In reality, predictive analytics should be used to prepare for effective transportation after the goods has been placed into a channel. There are a lot of moving components in supply chain management overall. However, as transportation accounts for somewhere between 40% and 60% of your expenditures, that must always be the first priority.

The activity of managing the safe movement of products and services is known as supply chain management. This might differ from the product provided by the particular industry, depending on the industry. The process takes into account the whole transformation of raw materials into finished goods before they are delivered to the final consumer. The fascinating portion of this procedure is the management component. Managers are expected to reduce the time and resources needed to improve the supply chain's efficiency. SCM is all about streamlining this process to achieve a competitive edge and create satisfied consumers. The creation of information systems to keep track of everything is included in SCM, as is the manufacturing of goods. The chain comprises three key parts from beginning to end, which helps to streamline the

procedure. These elements include purchasing, manufacturing, and transportation, which is crucial. To expand your firm, you must have a concise and cost-effective transportation plan. It entails setting up an extensive network of organized transportation systems and distribution schemes for both receiving and transporting goods. Nobody loves to get late purchases, so a smooth delivery process is what keeps your consumers coming back for more.

SCM activities involving transportation: The supply chain is held together by the metal link of transportation. Since raw materials are carried from dealers or the location where they are acquired, to the location where they are made, and then to the ultimate consumer, every stage of the process is related by transportation. Without a reliable and cost-effective shipping strategy in place, you risk losing a lot of money, which might give you an unfair competitive advantage. Let's examine the significance of transportation in a supply chain in more detail. Already, running a company is expensive. A smart transportation system in place may help someone save a tonne of money with careful planning and mapping. There are several means of transportation (air, ocean, or land), fuel prices, and weight considerations. A comprehensive freight audit is advised in order to minimize the expense of such logistics. A company's first focus should be its customers, who should be followed closely by the supply chain. One strategy to guarantee that goods reach your client on time and in excellent condition is to tighten up your transportation lines. This very little element is considerably more crucial in a large-scale process. A company has to be aware of the many levels of priority that shipments may have. It may be more crucial to get certain shipments sooner than others at a somewhat regular time. Because of this, segmenting shipments depending on variables like distinct clients, product types, suppliers, etc. is crucial. TMS, or transportation management system, is software that makes it possible to monitor your transportation network consistently and effectively. When it comes to analysis and making wise judgments, this really aids you. Using one platform, a TMS allows you to monitor route planning, fleet management, fuel costs, cargo handling, and customer interactions. Businesses may develop through extending their worldwide reach, for example. They would need to devise means of shipping shipments all across the globe for that to happen. This entails combining several forms of transportation and determining the quickest combined route to make the goods accessible globally. The prior idea is expanded upon in this sentence. Every nation has used trucks as their primary means of transporting goods. They may travel further than the railway lines permit on the ground because they are substantial. The ideal approach for small enterprises to handle their transportation requirements is with a fleet of vehicles. Global commerce is at its healthiest point ever as a result of flexible and cross-border transportation systems. With careful planning, companies may grow their markets while simultaneously boosting the economies of their respective nations. The benefits of numerous forms of transportation have made the globe smaller thanks to global commerce.

Few activities in your supply chain have as much of an influence on how efficiently your business operates as transportation. It's an essential component of the supply chain that is crucial to establishing and preserving your company's reputation. The quality of the shipment may make the difference between orders being cancelled and increased customer happiness.

So, the key competitive differentiation between organisations is often good transportation management. It affects how quickly and, to a larger degree, how much, your clients pay for their items. Transportation is more than just a way to move things from one place to another from the perspective of logistics. It is a method of enabling all additional significant supply chain procedures. Transporting raw materials, intermediate items, and finished goods from their place of origin to their final destination helps your operations run more efficiently. These transportation services connect each component of the supply chain.

A lean inventory is maintained by effective transportation management, which improves the efficiency and smoothness of product movement through your facilities. Improving the flow of items into and out of your warehouse may help you save money on transportation and storage while also cutting down on wait times. A crucial component of transportation management is making certain that completed goods are delivered to customers on schedule and in the same condition as when they were transported. One of the few steps in a supply chain where businesses work directly with consumers is transportation. As a result, assuring prompt delivery while taking precautions to prevent delays may boost customer satisfaction and build your brand's image for dependability and trustworthiness. Extending a company's worldwide presence is one strategy for growth. Because last-mile delivery is so important to keeping consumers satisfied, it is an essential component of logistics and supply chain management. However, owing to geographical and physical limitations, doing it properly is exceedingly challenging. On land, trucks have long been the main form of transportation. They can go through terrain that other forms of transportation can't and reach isolated locations. No matter where customers are, things are accessible to them via transportation. Your supply chain's performance relies on how well you employ a suitable transportation system strategically. To keep expenditures to a minimum, it's crucial to optimise transit routes. The deterioration of roads and other transportation infrastructure is a major problem in the transportation industry. Depending on the clients, items, season, and other considerations, each shipment will get varied levels of priority. It might sometimes be beneficial to have certain high-demand items delivered more rapidly rather than all products sent gradually. As a result, it is necessary to segment the modes and routes of transportation in order to represent these intricate realities. A fully efficient transportation system also needs a variety of types of mobility. A product often travels via many distinct modes before it reaches a distributor or end-user. The foundation on which businesses build their profitability and company success is now customer service. Businesses must speed up order fulfilment and figure out how to send products using the most efficient, dependable, and affordable means of transportation in order to keep up with rising customer expectations. A transportation management system (TMS) is essential for supply chains in every sector since, regrettably, transportation is often a costly and challenging procedure for most businesses. A TMS gives your insight into your daily transportation operations, ensuring that freight and other items are delivered on schedule. Any company's logistics budget includes a significant chunk for freight and fuel expenses. Fortunately, software programs like DATASCOPE WMS provide distributors the additional level of transparency they want. In addition to the TMS module, DATASCOPE's cloud-based WMS includes modules for load planning, shipping, and receiving. Together, these modules provide a more comprehensive understanding of your whole transport ecosystem.

CONCLUSION

When referring to a supply chain, the term "transportation" describes the movement of goods from one place to another. This movement starts at the beginning of the chain when materials arrive at the warehouse and continues all the way to the end user when the customer's order is delivered to their door. The chapter discuss about the transportation's essential elements in supply chain management.

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CHAPTER 8

INVENTORY STRATEGY IN SUPPLY CHAIN MANAGEMENT

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Abstract:

An inventory strategy is putting procedures and systems in place to control the movement of goods across the supply chain, from production and acquisition through storage and shipment. Tracking your inventory strategically can ensure that you have the correct things in the proper locations. To react promptly to changes in demand and ensure that you correctly fill every order by using an efficient inventory strategy. In this chapter discuss about types of inventory strategies, inventory management for your main company, have a backup supply chain, inventory plays a role in supply chain management.

Keywords: Distribution, Inventory Strategy, Supply Chain Management, System.

INTRODUCTION

Inventory Management:

Having procedures and processes in place to control the flow of goods from production and procurement through warehousing and shipment is referred to as having an inventory strategy. The management of an inventory plan enables you to maximize production, items in transit, storage, and costs while making sure you have adequate inventory to meet demand. Inventory accounting also keeps your company structured so you are ready for tax season [1].

Types of Inventory Strategies:

The effectiveness of an organization's inventory strategy frequently determines the performance of its supply chain. Companies may have shortages or end up with excess inventory on hand without a solid plan in place. These companies should educate themselves on which of the several inventory strategy models available best suits their requirements in order to improve productivity and satisfy client demand.

Conventional Manufacturing Strategy: The assembly line runs continuously in a classic or conventional configuration. Whatever the state of the next station at the time, when one department or area has finished its task, it sends the product there. This tactic avoids idle workers and equipment, but should bottlenecks in the line develop, workers can find themselves waiting for supplies or being overburdened with incoming goods.

Just-in-Time: The shortcomings of the conventional paradigm are addressed by a just-in-time inventory strategy. Companies only buy units under this form of management system as needed

to satisfy client demand. As inputs go through the three stages of raw materials, work-in-progress, and final goods, they are categorized. Just before production begins, materials are delivered, and they are put together in time to dispatch to customers. Businesses that use this method see significant cost reductions and improved operational efficiency.

Planning for Material Requirements: Inventory management software is used in materials requirements planning. To maintain minimal inventory levels and sustain smooth production, MRP software divide inventory requirements into planning periods. This model works backward from the intended finished product to find the components and raw materials needed to manufacture it. It is created to determine what is needed, how much is needed, and when it is needed. MRP systems aid managers in planning for usage of assets and allocating production periods, despite being expensive to deploy.

Economical Order Quantity: The economic order quantity model presupposes that inventory will exhaust at a fixed pace until it reaches zero and that customer demand will remain constant. Businesses who use this technique keep a close eye on inventory levels and place a fixed order for additional units if their supplies run low. This reorder point is precisely timed so that the business will receive the materials when it needs them, preventing shortages or overproduction of the industry. here are four approaches to ensure better supply chain inventory management.

Keep a backup supply chain for your primary business: A fantastic strategy to guarantee that the supply of key commodities for your organization continues unbroken is to have alternate suppliers dispersed throughout different geographical areas. Even while it may not appear to be very effective, this does help reduce the risk of black swan incidents.Maintaining reserve or safety stocks is another strategy to stop operations from coming to a total stop.Volkswagen has local supply networks in both China and Europe. Volkswagen turned to its European suppliers when the pandemic damaged its supply chain in China, and then switched back to Chinese suppliers when the pandemic shut down Europe, according to the survey study.

Reconsider your sourcing plans and vendors: 44% of survey participants thought their companies depended too heavily on suppliers from specific nations. They would prefer to find suppliers in the future from a larger range of nations, perhaps even near-shore options.In order to create resilient supply chains that can be continuously monitored, more organizations are considering sourcing strategies that involve regional suppliers and greater openness.

Adopt technology and digital supply chain transformation: According to the poll, less than 40% of the organizations use advanced analytics and digital platforms, and less than a third use the cloud or IoT. For inventory management to be effective, that must alter. Modern warehouse and inventory management software can assist businesses in accessing real-time data for improved visibility and more precise predictions. Businesses may increase total supply chain visibility by tracking key indicators like inventory turnover, gross margin, and customer order fill rate with the aid of AI and sophisticated analytics. Companies may better comprehend how their products flow through their warehouses automatically with the aid of inventory management software.

Make your organization less compartmentalized and more collaborative: Having the appropriate products in the right location at the right time is the aim of efficient supply chain inventory management. Siloed organizational data and isolated departments make it harder to maintain the transparency necessary for efficient inventory management. The solution is to make it easier for information to move between departments.

Inventory's Function in Supply Chain Management:

A supply chain is a network between a company and the manufacturers and distributors of the goods, materials, or services that the company need to function. A supply chain may include a large number of participants, such as producers, distribution centres, trucking firms, merchants, and warehouses. Some companies have straightforward, regional supply chains. And other companies have intricate, global supplier systems. No matter how big or small your company's supply chain is, keeping it in good working order requires effective inventory management. In many different ways, inventory management assists firms in maintaining their supply chain. Three of the most notable elements are listed below:

Buying Inventory: A strong inventory management system makes sure you have the necessary inventory on hand to meet consumer demand, regardless of whether your business stocks supplies, raw materials, or finished goods. Demand projections and current inventory levels typically have an impact on the decision to purchase inventory.

Maintaining Inventory: Company needs a place to put the new goods when it comes in. Storage is the second part of supply chain inventory management because of this. That may entail a storage closet for some businesses or perhaps an off-site storage facility. And for some companies, that would entail a vast network of warehouses dispersed over the entire nation.

Selling Supplies: You have acquired or produced finished things to sell, and you have also stored them. The merchandise must be sold as the last phase in order to, hopefully, make a profit. Your company may offer inventory to customers directly via your website or in person, through a variety of additional channels, or to other shops.

Inventory management has evolved from a solitary backup protection function to a crucial company function that supports survival and growth as the marketization process has advanced. The most crucial component of supply chain management is inventory control. When compared to conventional inventory management, the new management style causes inventory management to exhibit several new traits and issues[2]. In order to strengthen the integration of the whole supply chain, which may increase an enterprise's agility and speed of market reaction, it is essential to revisit the issue of inventory control and provide new inventory management solutions tailored to integrated supply chain management. This research examined the present state of joint inventory management to optimise the inventory based on a thorough examination of the joint inventory management model. Using the fundamental concepts of the ant colony algorithm and fuzzy model, a more systematic and better optimization model of the supply chain inventory was suggested in light of the successes and drawbacks of the existing study [3]. All sectors of the health care industry must strive to provide excellent service for medical supplies and implement efficient inventory management procedures. In addition to causing financial

losses, medicine shortages and incorrect usage of medications may negatively affect patients. Due to the fact that they have not addressed how drugs are managed, provided, and utilised to save lives and promote health, many health systems and hospitals have trouble attaining these objectives. Research is necessary to comprehend how the health care sector operates and to develop instruments for strategic decision-making in the pharmaceutical supply chain, patient safety, and public health. We provide an inventory model for a supply chain including a pharmaceutical firm and a hospital supply chain that incorporates continuous review with manufacturing and distribution. The model takes into account a variety of pharmaceutical items, varied lead times, allowable payment delays, space availability restrictions, and the degree of customer service (CSL). We provide a process for figuring out the best options for inventory lot size, lead time, and the quantity of deliveries to meet hospital CSL objectives at the lowest possible supply chain total cost. The applicability and behaviour of the model are shown by a numerical example [4]. It has become a critical topic in the area of supply chain management since the financial tsunami of 2008 how to alter the target inventory level dynamically and promptly in order to mitigate the risk that a company confronted in a market where demand is changing quickly. In order to accomplish the aim of dynamically altering the target inventory level, this research investigates supply chain cooperation solutions by leveraging the theory of constraints. The timing of a shift in market demand is identified using three time-series data mining techniques: The Sequential Probability Ratio Test (SPRT), the CUSUM chart, and the Auto-regression Test. The desired inventory level is modified based on the findings. The relative effectiveness of the three systems' demand-change detection is investigated using simulation techniques. Utilizing the three ways for detecting demand change, the methodologies are also utilized to investigate the impact of different inventory management systems on inventory performance [5]. Given their fragility and perishability, fresh goods readily increase inventory costs and need careful planning for inventory management. Therefore, multi-echelon inventory control is crucial for fresh product supply chain systems. Few control models of the multi-echelon inventory, however, have ever taken into account the pace at which perishable goods deteriorate as a variable element. In this paper, a multi-echelon inventory control model for fresh products is designed and optimized on the basis of taking into account the perishable characteristics of fresh products, combining the deterioration rate with the inventory control model, and obtaining the optimal solution from the entire supply chain through the optimal fitness function by genetic algorithm. The two inventory techniques are finally simulated using Flexsim, both before and after optimization. It is confirmed that the improved inventory management approach has reduced costs after simulation comparison and analysis. The study's findings have practical implications since they may assist fresh product supply chain managers in cost- and time-saving inventory management choices [6]. This study focuses on employing reserve capacity and inventory to manage interruption risk in supply networks with stochastic demand. Reserve capacity may be employed in a proactive manner in response to a disruption, while inventory can be thought of as a speculative risk reduction tool. We calculate the best reserve capacity production rates and inventory levels for a company that faces the possibility of a supply chain interruption. The inventory approach, reserve capacity strategy, mixed strategy, and passive acceptance are the four basic risk mitigation techniques that we completely characterize.

We demonstrate how supply chain variables and product features (functional vs inventive) affect the most effective risk reduction technique (agile versus efficient). This project was motivated by a risk management issue at a major pharmaceutical business [7] Fresh agricultural goods now reach the Chinese market mostly via the "agricultural superdocking" method, which has received substantial official backing. This study develops an integrated inventory model for fresh agricultural goods of "farmers' professional cooperatives distribution centres supermarkets" based on the examination of fresh agricultural products supply chain inventory management under the "agricultural superdocking" mode. A model is suggested that optimises the supply chain's total profit while taking into account many members at each echelon. The distribution centre is in charge of not only storage, processing, and distribution but also coordinating the production and availability information of farmers' professional cooperatives and the order sales information of supermarkets. The model assumes that the market demand of fresh agricultural products is influenced by freshness and sales prices. To resolve the nonlinear optimization issue, a better genetic algorithm is created. Results of a case study demonstrate that under the specified supply chain distribution procedure, the best supply and replenishment strategy is produced [8] The bullwhip effect phenomena is discussed at the beginning of this article, followed by an analysis of ways to improve inventory management tactics and lessen the bullwhip impact in supply chain management. The instance of McDonald's and its third-party logistics system HAVI collaboration is then examined to examine the mechanism of cooperation between the two businesses. We create a one-multi distribution model and create a mathematical model for decreasing inventory and enhancing service level, supposing that McDonald's outlets, a leader in logistics activities supply chain, adopts the higher and lower inventory management approach.

DISCUSSION

Inventory Management's Importance in Your Supply Chain

Designing the supply chain capabilities to reduce the requirement for inventory is the first step in achieving the greatest amount of corporate value. Inventory control is essential for managing the residual stockpiles of inventory and ensuring that the supply chain moves at the pace of international trade once this strategic job is finished. The fast use of automation and machine learning is the most important trend in inventory management systems, as it is in many other sectors. Inventory managers have an overwhelming amount of data to go through since data is gathered at every stage of a global supply chain. Only if you can evaluate the data and apply it for inventory optimization does it have any value for supply chain management, and that is where AI comes in.

AI is widely used in inventory management systems to fully use large data. You can quickly make modifications to keep your supply chain flowing by analysing patterns in your logistics, raw material, and warehouse operations in close to real-time. Using predictive analytics to identify tomorrow's trends today, big data may even provide you the ability to look into the future. Despite these improvements in contemporary supply chain management, inventory control is nonetheless made more difficult by global supply networks. In light of this, effective inventory management is essential for supply chain planning. Companies need to do a better job emphasising the discipline's value given the logistical and financial difficulties encountered over

the previous year. Thankfully, efforts to use big data, AI, and machine learning are boosting inventory management solutions that let supply chain managers meet rising production and fulfilment demands quickly. The COVID-19 pandemic's irregular demand fluctuation dispelled any qualms the globe had regarding the value of a responsive and adaptable supply chain. Today's supply chains need to be quick and flexible in order to provide benchmark inventory management capabilities where it is necessary. Careers in global supply chain management are more sought-after than ever. Professionals with sophisticated inventory management skills have fantastic job opportunities. Even if inventory management is not your area of expertise, a supply chain management degree will help you develop the abilities you need to stand out to prospective employers.

Inventory Management Skills Are Important in Supply Chains: Although it is essential, inventory management is an often disregarded aspect of supply chain management. Experience with inventory management is one of a potential supply chain manager's key abilities. Companies should look for a supply chain manager with strong inventory management skills for the following reasons: Poor inventory control may have an impact on the whole business and have a negative financial impact. For instance, the institution's ability to deliver medical services would be significantly damaged if a supply chain manager for a hospital chain failed to ensure enough inventory of a vital medical commodity, such as syringes or personal protective equipment (PPE)A substantial inventory management issue might also arise from having too much inventory. Overordering costs money, makes managing the warehouse more difficult, and poses the risk of a loss if the organisation cannot utilise or sell an old or expired goods. Consider a scenario where a supply chain manager for a clothes company neglects to carefully track client demand. If that happens, the business can find itself with unsold inventory from a previous season. The overabundance of discounted goods might hurt the brand's reputation with customers and have a major negative influence on their profit margins if the firm sells these things on the discount market to recover part of its expenditures. By maintaining a consistent inventory flow, effective inventory management, on the other hand, may increase profitability, improve supply chain visibility, and improve operations. For a supply chain management in the modern era, inventory optimization is the gold standard.

Risks of Inventory Management for Supply Chain Managers poor forecasting of inventories. There is no such thing as a flawless prediction, but if you don't have any knowledge of how your supply chain's inventory is controlled, it's very difficult to match supply and demand for your products. Supply chain managers must solve the problems of inventory waste and liquidity by using contemporary SKU monitoring and paying close attention to data from retail partners and distributors. Driving sales and distribution throughout the product's shelf life. The shelf life and expiry of vaccinations were among the top supply chain challenges that businesses, governments, and consumers were thinking about. States rushed to increase awareness and made significant investments to get vaccinations into the hands of the populace, yet there is still a sizable amount of product waste. The bottom line expenditure is the main concern in the conventional approach to supply. We were concerned about the opportunity cost of not spreading the sickness in this instance as well.

Carrying expenses since there aren't enough warehouses. Although brick and mortar stores have faced considerable difficulties over the last year, the growth of e-commerce has continued to boost product demand across sectors. There is a massive grab for real estate. This implies that governments will be under more pressure to rezone land or provide permits for further building, which isn't happening soon enough. A scarcity of inventory storage space might result in higher costs owing to peak demand, thus it is crucial possibly more so than ever to maintain the flow of goods from the warehouses to the final consumer.

Inventory Management ComponentsLong before the items ever enter the warehouse, inventory management begins. the components of effective inventory management for businesses that recruit qualified individuals with a broad education in supply chain management.

Inventory management: Think of inventory optimization as the process of balancing inventory depending on demand: ordering exactly the right quantity rather than too much or too little. Utilizing a dynamic inventory management approach can help you find the sweet spot with the appropriate inventory amount for each item you stock. The visibility of the supply chain from raw materials to sales data is necessary for an optimal inventory management system. It necessitates flexible supply chain planning that can react immediately to shifts in consumer demand or disruptions in your worldwide logistics operations. It will be your job as the supply chain manager to continually recalculate the ideal inventory levels to satisfy client demand. One of the things that makes supply chain management such an intriguing profession is the fluid nature of inventory management.

Management of transportation: Management of transportation and inventory are interdependent. Your supply chain's transportation component generally moves goods from the production to the fulfilment facility or distribution hub. Because a transport delay may destabilize a carefully organized global supply chain, proactive and aggressive transportation management is essential to just-in-time supply chain management. Maintaining insight into your logistics operations, developing repeatable transportation processes, and being prepared to quickly pivot in order to sustain inventory flow are all part of your duties as a supply chain manager.

Management of the warehouse: Distribution, fulfilment, and storage are all included in warehouse management. Customer satisfaction depends on choosing the right warehouse sites to match customer demands for quick delivery and making sure that fulfilment processes go smoothly. Effective warehouse management enhances inventory visibility and reduces loss from theft or damage. Instead of assuming that transportation specialists can provide the caliber of fulfilment services your firm requires without sufficient control, it is crucial to incorporate your storage operations in your supply chain visibility.

Management of inventory effectively: For efficient inventory management, supply chain managers use a wide range of strategies. You will be knowledgeable about numerous techniques to choose the right inventory level and inventory flow for various goods after passing the MS SCM - Online exam. The right context for this task will also be provided by reading the GSCI white paper, "End-to-End Supply Chain Planning Framework and Key Concepts." Here are some common inventory management methods and procedures:

Demand Supply Integration: The process used by executives to decide which supply and demand actions to take (such as investing in inventory and taking on customer service risk) in order to maximize corporate overall value. This procedure guarantees the best overall judgments and cross functional adherence to the company strategy. This procedure is explained in depth in the GSCI white paper on "Advanced DSI Best Practices."

ABC evaluation: A technique for inventory control called ABC analysis divides items into three categories. Tier A goods are either those with the greatest value or turnover. These items also have the greatest degree of inventory visibility, including frequent inventory management, and the highest risk of stockouts due to stolen goods or backordered inventories. Since Tier B items don't move as quickly as Tier A products, inventory management regulations are laxer for them. Tier C item counts are sparse since these products sell the least quickly.

Supply chain management is focused on the goods for which inventory visibility is most important. This method of inventory management improves both time management and inventory.

Predicting the demand: Forecasting demand is crucial to inventory control. Demand projections serve as the foundation for planning the supply chain for the next quarter or the following year.

Demand estimates come in two different categories: Using information about previous sales, passive demand forecasting makes projections. For established businesses with thorough sales data and steady market share, passive demand forecasting may be effective. Active demand forecasting projects consumer demand by taking into account growth predictions and outside market influences. Active forecasting techniques are effective for new businesses, expanding corporations, or sectors where demand varies due to outside causes.

A variety of techniques for developing demand projections have been developed by academics and supply chain management experts, including: Market analysis, which relies predictions on trends to show ways to increase market share, Salesforce Composite, which depends on the market expertise of the sales team Using the Delphi technique, which bases forecasts on the agreement of a panel of experts,

Order quantity again. The inventory level at which you must place a reorder is known as the reorder quantity. The rate of sales, the length of time it takes to produce and ship a product, and the amount that will be ordered again. You must take into account every link in the supply chain, from the accessibility of raw materials to logistics and transit times, in order to determine the reorder amount. Setting proper reorder amounts for each item in your supply chain and maintaining enough inventory visibility to know when to place a buy order are the major objectives of effective inventory management.

Economical order size. An inventory flow that satisfies customer demand and the expense of maintaining goods on hand may be balanced using a computation known as the economic order quantity (EOQ). Start with these informational elements to determine the economic order quantity: The amount of goods transported over the previous year, or the demand rate. The price of the goods you must purchase to satisfy demand during the sales period. The expense of

stockpiling goods. Knowing a product's EOQ is crucial for reorder quantity calculation and inventory optimization.

Safety supply: The extra amount of merchandise to maintain on hand beyond the reorder quantity is known as safety stock. Averages are used to determine the amount of reorders, but client demand might surge and logistics can stall. The Suez Canal catastrophe, which stopped ship traffic on three continents, served as a cautionary tale about the value of safety stock. This kind of occurrence may be lessened by keeping some reserve stock in distribution hubs close to a company's biggest clients. The continuous flow of inventory is one of supply chain management's primary objectives. Your supply chain is never disrupted because safety stock shields you from the unforeseen.

Graduate programs for supply chain managers in inventory management: To stay up with the most recent developments in inventory management and to compete on the job market, supply chain management specialists require a strong foundation in data analytics. One of the best ways to acquire the advanced abilities that top organizations want is to pursue a graduate degree in supply chain management.

CONCLUSION

A corporation must balance client demand with available storage space and financial constraints, which makes inventory management essential in the supply chain. In order to integrate lead times for deliveries with production schedules, managers need insight into the supply chain (including procurement, manufacturing, fulfilment, etc.). A highly difficult but crucial component of the supply chain is inventory management. Inventory-related expenses including storage, transporting, and ordering costs may be decreased with the use of an efficient inventory management system. Inventory control, different inventory techniques, ensure your core company has a backup supply chain, the role of inventory in supply chain management in this chapter.

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CHAPTER 9

CUSTOMER SERVICE STRATEGY IN SUPPLY CHAIN MANAGEMENT

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Abstract:

In the supply chain, customer service is crucial. It is in charge of how consumers feel about the merchandise and the business that sells it. David Kiger is aware that, regrettably, today's definition of customer service has evolved into one that is closely linked to how businesses operate and the revenue they produce. A customer service plan outlines the level of service and attention your company will provide to customers as well as how those levels will be evaluated.

Keywords: Consumer,Customer Service, Strategy, Supply Chain Management

INTRODUCTION

The term customer service strategy refers to a set of cost-effective, value-added services offered to take use of the marketing potential for actual sales as well as to keep customers happy, loyal, and motivated to the company's offering.

Customer Service Strategy Components:

Availability: The ability to have merchandise on hand when a consumer requests it called availability. It is typically seen that a firm would expend enough time, money, and effort to develop consumer demand but then fall short of having a product on hand to satisfy customer needs. Three performance indicators are used to determine availability[1]–[3].

Lock out frequency: When a company has enough inventory to meet demand from customers, there is no stock out. Stock out frequency is the likelihood that a company won't have enough inventory on hand to fill a customer order. The total number of stock outs across all products reveals how effectively a company is run in terms of basic service commitment about product availability.

Fill Rate: The degree of stock outs is gauged by fill rate. When a product is unavailable, it's critical to know how many the buyer desired. The fill rate is 95%, for instance, if a buyer requests 100 units of a product but there are only 95 on hand. The level of service to be provided for particular products can be differentiated using fill rate. The fill rate of 95% can be acceptable if some of the items are not essential. On the other side, a fill rate of 95% could cause a stock out and could disrupt operations if all 100 of the ordered products were essential to the customer.

Fulfillment of customer's order: Order fulfilment for customers is one of the most significant performance indicators for product availability. It checks to see that every aspect of a customer

order has been completed to an acceptable level of performance. When it comes to a complete shipping, even one missing item from a customer's order counts as zero.

Operational Effectiveness:

The amount of time needed to deliver an order to a customer is considered operational performance. The definition of operational performance includes speed uniformity, adaptability, and malfunction recovery.

Speed: The period of time between when a customer places an order and when the product is delivered and prepared for the customer to use is referred to as speed in operational performance. The majority of clients naturally want quick order cycle performance. Many just-in-time and fast reaction logistical techniques depend on speed. However, because speed of service raises overall cost, not all clients may require the fastest speed.

Consistency: The frequency with which real cycles complete at the scheduled time is used to gauge operational performance consistency. Although service speed is vital, most logistical managers place a higher value on consistency because it immediately affects a customer's capacity to organize and carry out their own operations. Because it is very usual for clients to include a desired date and even a delivery appointment when placing orders, consistency is essential for efficient logistic operations. In actuality, buyers routinely place orders well before they actually need them. Customers find it quite difficult to comprehend why failure occurs in such circumstances.

Flexibility: Flexibility refers to a company's capacity to meet ad hoc requests from customers. For instance, a common pattern for customer service may be to ship goods in a complete lot to the client's warehouse. However, the customer may occasionally want to have smaller shipments delivered directly to specific retail locations. The ability of a company to handle such unforeseen circumstances serves as a gauge of its logistical competence.

Malfunctions Recovery: Even if the company's logistical operations are well-managed, malfunctions will nonetheless happen. It is challenging to consistently fulfil service commitments on a daily basis. Adjustments can be made to avoid unique circumstances. For instance, if a warehouse runs out of a necessary item, it may still be possible to get it from a different facility by using a speedier route of transportation. The customer would be informed of such circumstances.

Customer Dependability: Service reliability refers to a company's capacity to carry out all order-related tasks and update clients about logistical operations. If a shipment is reliable, it will likely arrive without damage, have accurate and error-free invoices, go to the right destinations, and include the exact amount of product that was purchased. In addition to this, service dependability includes the ability and desire to give consumers accurate information about operations and order status.

Identification of Customers' Service Needs:

Introduction: Recognizing customer service demands is crucial for retaining current customers as well as attracting new ones. Today, building relationships with clients is the main focus of marketing. The notion is that we should work to satisfy clients to the point where they don't feel the need to even examine different offers or suppliers.

The following three stages can be used to categories the process of identifying a customer's service needs:

Essential aspects of customer services identified: Through thorough research, it is crucial to build an awareness of the service requirements of clients. Finding the variables that affect a customer's buying choice is the first stage. A short research campaign should be started as soon as the decision-making unit in a particular market has been identified. Personal interviews with a representative group of buyers should serve as the foundation. These interviews serve the objective of identifying the factors that are crucial from the perspective of customer services, such as price, product quality, marketing, etc.

Establish the Relative Value of Customer Service Components: One straightforward method for determining the relative importance of the service components is to have a representative sample of consumers rank them in order of importance, from "most important" to "least important." Practically speaking, it is challenging, especially when there are several components. Another approach is to utilize a rating scale, where respondents are asked to rank each component from 1 to 10 based on how important they believe it is.

Identification of Customer Service Segments: The last step is to compare preferences once the importance given by various responders to the service criteria has been established. Cluster analysis is a key method for determining customer service segments. It uses computers to analyses a piece of data and attempt to match as many responders across as many parameters as it can.

In 2020, the COVID-19 epidemic has surely had an impact on every region of the globe. Additionally, it has stressed how crucial it is to manage supply chain risk and create an agile supply chain. To make their students more aware of the effects of supply chain interruptions, supply chain management teachers will probably wish to include risk management ideas and tactics into their curricula. Unfortunately, the main supply chain management text books as well as the larger collection of supply chain management pedagogical research articles presently lack adequate coverage of supply chain interruptions and risk management. We have created a reading with a set of related discussion questions and exercises to help instructors fill in this gap in the literature. The reading explains the reasons behind the pandemic's lack of toilet paper as well as both immediate and long-term solutions to strengthen the supply chain going forward. Students may get a more complicated knowledge of the intricacy and connectivity of supply chain processes in delivering goods and services to clients by concentrating on a disruption they have personally experienced.

The goal of this research is to multidimensionally assess the innovative techniques for the management of a green supply chain. The paper is unusual in that it proposes a hybrid model using an IVIF (interval-valued intuitionistic fuzzy), DEMATEL (decision making trial and evaluation laboratory), and IVIF MOORA (Multi-Objective Optimization by Ratio Analysis) hybrid approach for each step of QFD. The findings show that, with respect to successive stages of QFD, understanding customer expectations through customer relationship management is the most crucial innovation strategy for the green supply chain management in the energy sector, while benchmarking the competitive market environment ranks relatively last. Therefore, it is advised that energy organisations have a strong customer relationship management system. In this situation, these businesses should do a thorough research to discover what their direct consumers anticipate from them. With the aid of this problem, these businesses should provide their goods and services in accordance with these expectations. It is also said that developing new services and products is crucial for energy firms to increase their innovativeness. A department for research and development should be established for this reason, and the suitable individuals should be hired. Additionally, varied viewpoints from various stakeholders, including clients, staff members, and suppliers, should be gathered. The energy firms may seize the chance to grow their market share since happy consumers would favour these businesses[4]–[7].

Customer participation (CP), a strategy for enhancing the customer experience while cutting costs for service providers, has drawn a lot of attention in the service literature. Although its advantages are undeniable, less is known about its drawbacks. By fusing studies from the marketing, operations and supply chain management, strategy, and information technology domains, this study presents a thorough model of the risks of client engagement in service delivery and offers a conceptual basis to fill this gap. Design/methodology/approach: Insights from studies in marketing, operations and supply chain management, strategy, and information technology are used to develop the model deductively. Findings: This study addresses strategies that businesses may reduce three kinds of possible CP risks (i.e., market, operational, and service network). Using the model as a foundation, it creates a tool for managers to estimate the risk of CP rises. Research constraints and consequences Future study on consumer engagement, especially in fields like sharing economy services, service delivery networks, and experience services, may be supported by the conceptual paradigm put out in this article. The risk assessment tool provides managers who are thinking about increasing client engagement in their business with clear rules. Originality/value: This is the first effort to conceptually identify customer participation risk and create a thorough model of its causes and mitigation tactics. In this work, a simple way for managers to assess CP risk is developed.

Express delivery is a rapidly expanding sector that makes it possible to help people all over the globe by moving items and documents from one location to another. Price, quality, dependability, and services all contribute to a company's success. However, there is little discussion of the effect of corporate value capture methods on the overall sustainability of the value generating process in the literature at this time. The goal of this review article is to create a model that connects management process effectiveness and efficiency to service delivery quality, job opportunities, and client retention. The association between effective management and client retention is strengthened, according to a thorough literature study, by advancements in e-commerce infrastructure. The mediation of automation in supply chain management in our concept is further explained in this article. This article makes a theoretical contribution to the body of knowledge on supply chain management and e-commerce in addition to having practical

implications for managing modern techniques to automate business processes for success in Private Express Enterprise, especially for the managers who are in charge of corporate performance [8]. The goal of this research is to determine how several aspects of customer-driven green supply chain management, such as internal green supply chain management, customer and supplier environmental cooperation, and supplier environmental monitoring, affect an organization's environmental performance. In Karachi, a survey of people working in the industrial and service sectors was carried out for the study's purposes. There was a questionnaire used to perform the survey. According to the findings, all factors examined in this study, including internal green supply chain management, environmental engagement with customers, and environmental monitoring of suppliers, have a beneficial impact on a company's total environmental performance. Applying green supply chain management concepts successfully may help a firm improve its environmental performance. Since it has emerged as the most important component of a sustainable environment, green supply chain management has become a crucial component in the modern day.

Dhruv Grewal *et al.* [9] More than simply cheap costs and cutting-edge items are necessary for survival in today's economic economy and competitive retail environment. Businesses must concentrate on the customer's purchasing experience if they want to compete successfully. Retailers must comprehend what "customer experience" really entails in order to manage a client's experience. Each point of interaction a consumer has with a company, a product, or a service is considered to be part of the customer experience. A company approach created to control the customer experience is customer experience management. It stands for a tactic that enables a mutually beneficial value exchange between the shop and its clients. The impact of macro variables in the retail environment and how they might affect consumer experiences and behaviors are the main topics of this essay. This should lead to greater customer satisfaction, more frequent shopping trips, bigger wallet shares, and better profitability. Several strategies are discovered to create a superior customer experience, including promotions, pricing, goods, supply chains, and locations.

Oswald A. Mascarenhas *et al.* [10] Traditional marketing approaches use the assumption that consumers usually interact with the items or services at the very end of their value chains as completed market offers (e.g., search, evaluate, buy, utilise). In this article, managers are urged to include target consumers at every point along the value chain. Enhancing customer relationship management in combination with supply chain management, employee relationship management, and store partner relationship management is the explicit goal of our new customer value chain involvement (CVCI) model. There are unquestionable benefits to CVCI, including the ability to continuously solicit customer input, allow more objective quality evaluation and judgement, and, most crucially, transform customer contentment into customer joy, which fosters enduring loyalty and helpful recommendations. The significance of CVCI and its management ramifications are examined[11].

DISCUSSION

One of the most important aspects of logistics and supply chain management is customer service. Customers learn about both the goods and the company providing it via customer service. Nothing could be farther from the truth than the belief of some firms that customer service has nothing to do with supply chains. In actuality, the product's journey to the client marks the end of

the supply chain. As a result, the firm hears from the client via customer service. Customer service is aware of all the annoyances and needs of the customers, and this information may benefit the supply chain.

The development of the supply chain's role

Until recently, the main focus of supply chain management and logistics was on delivering goods to customers at the proper time and location. Modern society has far larger goals to achieve, some of which include fostering organizational development and competitiveness. Shippers are under a lot of strain because of how interwoven and stretched supply chains are becoming. Up to 70% of corporate organizations say their supply networks are either "very" or "very," according to a Geodis supply chain study. Companies must adjust to a changing market because the supply chain is evolving into a crucial component that drives corporate success. Customers today demand higher standards for product quality, prompt communication, and delivery schedules. As a result, the business must have a solid logistics and supply chain infrastructure and exceed customer service standards. Expectations for the customer service experience. When a customer calls a company to make a purchase, schedule maintenance, ask a question, or challenge a transaction, they've grown to anticipate a particular degree of service. Among the expectations are:

1. Information In order for customer care representatives to handle any inquiries quickly and effectively, they must be informed with the company's goods and support systems.

2. Reliability The first offer and what the consumer receives in future contacts frequently shape their view of the customer service received.

3. Compassion. The employees must be attentive and polite while discussing problems and helping customers understand why things are done the way they are, even if the consumer may not always be correct.

How to improve supply chain management via the use of customer service

1. Give customer care agents training. Customer service representatives (CSRs) need to be taught to identify problems and develop solutions. They also need to be good at selling and understand the company's offerings so they can best assist the client. Sales-savvy CSRs are often better at addressing client pain areas and providing appropriate internal solutions. Having a corporate handbook for educating all workers is the best approach to assure a consistent experience from customer care representatives.

2. Connect order entry and customer service systems. Order fulfilment is sometimes a source of disagreement between businesses and consumers in today's fiercely competitive market. Due to the slow delivery of online orders, customer happiness might be altered. It is simpler for customer care representatives to assist clients in learning where their shipment is in the delivery chain thanks to the integration of the order entry and delivery systems. Customer satisfaction frequently rises as a result of this.

3. Ensure consistency among the subsidiaries. Many contemporary businesses have branches and subsidiaries spread throughout several states, nations, and even continents. In certain businesses, UK subsidiaries may have different quality standards and experiences than US subsidiaries. When customers go to the opposite nation, this may alter their experience. Across diverse locations and subsidiaries, customer service and supply chain dynamics need to be quite similar, if not identical. The best method to provide a unified experience is to teach the team in the appropriate abilities and business values.

4. Make the supply chain and customer service flexible. It is very difficult to provide first-rate customer service in the current complicated supply chain environment. Adapting the supply chain to consumer demands from the point of purchase till the product is delivered to the customer's door is one of the finest methods to handle such a difficulty. For customers that demand particular packaging or price, this could involve special shipping arrangements. In order to guarantee that customers' expectations and requirements are satisfied, customer service might work in conjunction with those responsible for packing and shipping the goods.

5. Make customer service accessible. There must be many methods to get in touch with the business in order to increase client satisfaction. Because not everyone feels comfortable using email or making a phone call, the business must provide a variety of alternatives for customers to quickly contact customer support. Social media, internet chat, mobile devices, and phones may be among them. As a result, regardless of the choice of communication medium, any customers who need to contact with customer care, sales, accounting, or any other department will find their communication to be quick and easy. In order to reassure consumers that their demands are being met across the whole supply chain, the customer support personnel has to be taught on how to provide great service to customers on every platform.

Two phenomena the phenomenon of integration, alliances, and political, economic, and industrial blocs, as well as the phenomenon of the information and communications technology revolution—have changed the fundamentals of many sciences as a result of the market's evolution and its opening up as a result of globalization. The formation of large multinational corporations via horizontal and vertical integration has been place in spite of the age of the blocs and alliances between nations. As a consequence, the idea of a supply chain was developed, and the development of information and communication technologies made it easier to integrate both independent businesses that are part of a supply chain and dispersed corporate entities throughout the globe.

In addition, one of the administrative foundations that the supply chain has changed is the type of relationship with the customer and suppliers. For the formation of the supply chain, its administration has moved toward greater cooperation and coordination, and a portion of the data and information (that was previously thought to be one of the company's peculiarities) has been exchanged with customers and suppliers. Additionally, the responsibility for inventory control has been transferred to their suppliers. The idea of the project resource planning system expanded to include suppliers and consumers in the project resource planning system. With the competition getting more intense, supply chain management began to consider the competition through the relationship management between suppliers, dealers, and customers in a way that

aims to beat the competitors. This competition calls for managers to make decisions quickly to avoid problems and take advantage of opportunities. Since the customer is the final consumer of the product and will provide the profit for the company, it has become essential.

The scientific revolution, which had a significant impact on all spheres of life, including management, is when supply chain importance first emerged. The interest in supply chains has grown essential in light of the scientific revolution and rapid technological advancement, and supply chain management procedures have become a crucial component of a company's efficiency and effectiveness. Without a doubt, the organization's supply chain.

Connection to Dealers: The significance of distributors depends on the kind of organization, the product produced, and the institutions in which they play a significant part, such as insurance companies, automobile manufacturers, large publishers, pharmaceutical firms, businesses that create various machinery, and others. In general, the distribution activity carried out by the numerous distributors determines the institution's growth, development, and financial success. The main goal of public relations with distributors is to keep them in close contact with the organisation so they can be informed of any changes to the goods or services produced, be made aware of the advantages of products, and be given all the tools and resources necessary to assist in the marketing and distribution of goods and services. Public relations can get in touch with distributors in a variety of ways, including through newspapers, trade publications, events, radio, television, training programmes provided by the Foundation to help distributors improve their persuasiveness, brochures and catalogues mailed to distributors, and reports sent to the organisation by distributors and agents outlining the status of distribution, sales, and challenges faced. Successful relationships with distributors often result in a rise in their affinity for the organisation and the services or products it offers, as well as an increase in the distribution effort and improvement of the effort.

Customer Relationships

We emphasize the significance of attracting and retaining customers, for it will help the business achieve a competitive advantage that cannot be imitated by competitors. Modern businesses looked for new ways to generate value for customers, and to establish a positive relationship with them. As modern businesses started to view the customer as a true partner and work to develop long-term relationships with him, which will assist the company in achieving. The business bases its relationships with clients on the simple yet astute premise that if you have any knowledge about your consumers, you can sell to them and effectively address their requirements. This knowledge focuses on the notion that customer service is a crucial component of customer relationship management, and it makes use of the change in goods and services to meet customers' requests and expectations in recognizing the necessary needs and requirements. The researchers "Carr & Pearson" defined the market orientation as the organizational state that helps in creating needed behaviors to generate and deliver superior value to customers, and thus achieve the superior investor performance of the company. In order for a company to have a competitive advantage, it must be able to continuously add value for its customers.

The Link between Customer Management and as well as Supply Chain Management

The necessity for long-term connections between clients and vendors. Supply chain management recommends combining it with customer-supplier interactions. In order to strengthen the vital business ties, they want to enhance supply chain management using the findings from study on successful families. They used their study, which was based on surveys and interviews with more than 6,000 prosperous families conducted over a 20-year period, to compile a list of six traits that prosperous families have in order to build the framework for a model of a successful supply chain connection.

They determined the support by comparing the suggested model of fruitful supply chain interactions with the body of prior research. The model's shortcomings in prioritizing supplier performance are highlighted openly. The authors proposed a supply chain relationship (SCR) model that offers three potential contributions to the literature on supply chain relationships, including a detailed conceptual framework (a successful family) for customer-supplier relationships, the addition of a relationship centered on principles, and a greater emphasis on appreciation or positive feedback than in previous studies.

By using a case study of the upstream portion of an integrated supply network, responsiveness in a supply network may be tackled from a combined relationship marketing (RM) and supply chain management (SCM) viewpoint. They recommended building responsiveness to produce value technically across the supply network by transforming products and to understand what the end user values. According to their definition, RM aids customers in understanding value in the context of business interactions, while SCM is effective for generating value via technical product-transforming processes. They suggest combining SCM and RM skills to accomplish responsive product supply from the standpoint of both end users and multi-tier supply networks. They recommend this strategy as effective for both organising cross-functional coordination in operations and strategically determining a company's place in a larger supply chain framework.

CONCLUSION

Customers are prioritized using a customer service plan, which improves client retention since they feel appreciated and cared for. Retaining consumers ultimately aids in business growth as they develop more loyalty, make more frequent returns, spend more, and recommend the company to others.

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CHAPTER 10

DESIGNING THE SUPPLY CHAIN MANAGEMENT NETWORK

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Abstract:

Building and simulating a supply chain allows for a better understanding of the costs and lead times involved in bringing products to market given the available resources and distribution channels. The functions of the distribution network and factors that affect distribution network design are covered in this chapter.

Keywords: Distribution network, Product Market, Simulation, Supply Chain Management, SCH Network.

INTRODUCTION

The network of the supply chain includes suppliers, factories, warehouses, distribution centers, and retail stores, as well as the raw materials, inventories of goods still being manufactured, and finished goods that move between the facilities. It is the group of physical facilities, means of transportation, and auxiliary infrastructure that the corporation uses to manage and eventually provide the goods and services it advertises. The components needed to create a supply chain network are available to all organizations or can be bought. A supply chain network may consist of manufacturing facilities, storage facilities, significant distribution hubs, ports, etc. A supply chain network may use a variety of vehicles, railways, container ships, or cargo planes among other forms of transportation. The numerous systems that can be used to manage and enhance a supply chain network include order management systems, transportation management systems, warehouse management systems, inventory management systems, strategic logistics modelling, replenishment systems, optimization tools, supply chain visibility, and more. These supply chain networks can now be automated in real time thanks to emerging technologies and standards, making them more effective than the straightforward traditional supply chain [1].

Distribution Network's Functions

In a supply chain, distribution refers to the actions taken to carry and store an item from the production phase to the client stage. Profitability is driven by distribution since it directly affects costs and the customer experience. Between the manufacturer of products and/or services and the ultimate consumers, there is a network of intermediaries. One of a manufacturer's most crucial resources is a robust and effective distribution network. The distribution is one of the marketing mix's four components. The marketing mix's other three components are product, prices, and promotion. Distribution significantly affects supply chain costs and customer satisfaction, making it a critical factor in a company's overall profitability. Effective marketing plan execution

depends on a good distribution system. This plan aims to provide customers with defined standards of service. The product is passed from one organization to the next during the distribution process before it is finally received by the customer or end-user. The channel or distribution chain are terms used to describe this process. In addition to the needs of the crucial end-user, each link in these chains will have its own unique requirements, which the producer must take into account. There may be a variety of other distribution channels:

Retailer (dealer), who sells to end consumers

Distributor, who sells to retailers

Advertisement, which is frequently used for consumer products.

In some industries, the distribution channels from manufacturer to customer are not always limited to tangible goods. It is possible to employ both direct and indirect channels. For instance, hotels may market their products directly or through intermediaries such as central reservation systems, airlines, travel agencies, and tour operators. For instance, rental services and franchising have both increased. In the travel and tourism industries, in particular, there has been some indication of integrated services, with services connecting to one another. For instance, connections between hotels, vehicle rental agencies, and airlines are now possible. Middlemen are frequently introduced into the economic market through supply chain distribution. Supply chains historically dominated the manufacturing and industrial sectors. These businesses turn raw materials like cloth, steel, minerals, and wood into useful products that people may utilize. Manufacturing and production firms rely on supply chain distribution to finish the process because they may not have the means to deliver goods to shops where customers may shop and make purchases in safety. Complex supply chains are becoming more prevalent. In order to control corporate expenses, it is crucial to consider how the distribution network is designed. The architecture of the distribution network includes:

Situating manufacturing facilities and distribution centers: Choosing the most effective method for transferring the product between facilities and warehouses and from the latter to clients.The goal is to open the most plants and warehouses in the best locations and capacities possible to meet all customer demand for the least amount of money overall (including transportation and production costs).Since cost-of-doing-business management is a crucial issue, it can set supply chain network optimization objectives ahead of rivals. Distribution network selection can help a supply chain achieve goals ranging from high responsiveness to low cost.

Considerations that Affect Distribution Network Design

At the most advanced level, a distribution network's performance should be assessed along two dimensions:

Meeting client needs affects a company's revenue

The price of supplying client wants (decide the profitability of the delivery network)

Aspects of Customer Service are affected by Network Structure:

Response time: Response time is the interval between placing an order and delivering the goods.

Product variety: Product variety refers to the range of options a customer seeks out from the distribution system.

Product availability: Product availability refers to the likelihood that a product will be in supply when a client order is received.

Customer experience: The simplicity with which a client can place and receive an order is part of the customer experience.

Order visibility: The customer's ability to follow their order from placement to delivery is known as order visibility.

Return ability: Return ability is the network's capacity to handle client returns of unsatisfied goods and how simple it is for customers to do so.

Customers typically demand the highest level of performance in addition to the aforementioned attributes. In reality, though, this isn't always the case[2]–[4]. Customers who order a book from Amazon.com, for instance, are more ready to wait than those who travel to a neighboring store to get the identical book. However, compared to the local store, customers may find a much wider selection of books on Amazon.

When developing a supply chain network, the supply chain sustainability (SCS) strategy takes into account the environmental, economic, and social elements of the supply chain's processes, components, technologies, and logistics. All types of waste, emissions, green management, worker health and wellbeing, market competitiveness, transportation, and network financial issues are among the factors that have an influence on SCS. Supply chain specialists should urge businesses to focus their efforts on creating sustainable supply networks and incorporate sustainability principles into various supply chain stages. In this research, we introduce the "supply chain sustainability index (SCSI)" as a novel measure to evaluate the overall sustainability of a biomass supply chain network using three criteria: environmental, social, and economic sustainability. In order to achieve the study's goal, a Bayesian Network technique is used to show the causal link between various factors and to provide a more thorough examination of the topic. Sensitivity analysis and belief propagation are used to examine and analyze the supply chain network's overall sustainability in more detail. The findings show that all three variables are essential for SCSI prediction; however, economic sustainability has the most impact on SCSI of the three, while social criteria have the least. In recent years, new methods and models for designing transportation networks have become necessary due to factors including competition, globalization-related issues, and environmental concerns. The design and management of sustainable supply chains have been seen as using a new and creative technique known as horizontal logistics collaboration. This strategy is focused on resource sharing amongst participants in related supply chains. This research offers a Systematic Literature Review (SLR) on cooperation and sustainability in the field of freight transportation. Its goal is to examine the available literature to show the studies that have previously been done and to spot any gaps and

promising areas for further study. Between 2010 and 2020, 89 articles were published, and those papers have been looked at. The findings demonstrate that, particularly in the area of collaborative network optimization, the integration of these three aspects of sustainable development has received minimal research. Additionally, the data reveals that few writers have worked on the issue of developing and managing an integrated supply chain, with the majority of authors concentrating their research on operational transport optimization.

When creating and enhancing food supply chain networks, traditional logistics management has not given much thought to environmental issues. According to national environmental protection laws, however, one of the most important considerations that should be taken into account is environmental protection. In this study, a mathematical model is developed to build and set up a multi-period, multi-product, multi-echelon green meat supply chain network while taking environmental considerations into account. We provide a formulation for mixed-integer multi-objective linear programming to concurrently maximize three goals: total cost reduction, total CO2 emissions from transportation minimization, and total facility capacity utilization maximization. We create a green meat supply chain network for Southern Ontario, Canada, to show the effectiveness of the suggested optimization approach. The suggested model is solved using a technique based on augmented -constraint method[5]. A collection of Pareto-optimal solutions is as a consequence obtained. Decision-makers have the option to trade off economic, environmental, and capacity utilization goals thanks to the collection of Pareto-optimal solutions. Our illustration demonstrates that reducing emissions without incurring significant overall expenses is doable. Finally, multiple decision trees are used to study the effects of uncertainty on the suggested model. A novel method in the literature involves utilizing decision trees to optimize a food supply chain, especially a meat supply chain, based on multiple goals under uncertainty. In recent years, research interest has turned to designing transportation networks, one of the most significant decision issues in supply chain management. In this research, a framework for designing a transportation network for pharmaceutical supply chains is introduced. There are three stages to it: determining the present distribution network's configuration; constructing an ideal distribution network while making the proper location-allocation judgments; and selecting the best transportation network by using the proper multi-criteria decision analysis approach (MCDA). Redesigning a transportation network for a pharmaceutical supply chain serves as an example of the suggested structure.

As the number of global crises, such as pandemics and natural catastrophes, increases, supply networks become seriously vulnerable and subject to interruptions. Modern management techniques like resilience to handle disruptions have become more popular among firms due to the dynamic and complicated supply chain environments[6], [7]. Additionally, by taking into account economic, social, and environmental factors, the sustainability strategy strengthens the resilience of the supply chain in the face of shocks. In this research, a mathematical model for creating a supply chain network that takes sustainability and resilience into account is developed. Suppliers were subject to interruption in this scenario with varying probability. The methodology aims to maximize suppliers' social and environmental ratings while lowering overall expenses. For probable disruption situations, a strong scenario-based stochastic programming method has been applied. In GAMS software, the multiobjective model is resolved using the -constraint

approach. The numerical results demonstrate how the model performed in a distinct scenario. Additionally, the supply chain's average performance in terms of each aim may be improved thanks to the robust scenario-based stochastic programming technique.

One of the key facets of e-commerce company management is supply chain network design. This idea is essential to e-commerce platforms. A key difficulty in this area, for instance, is the location-inventory-pricing-routing of an e-commerce supply chain. This industry created a number of significant issues for the contemporary world, such as sustaining the supply chain for returned goods, maintaining the confidence and happiness of consumers, and creating an appropriate supply chain with cost considerations. According to the e-commerce context, the study suggests using a multi-objective mixed integer nonlinear programming model to construct a closed-loop supply chain network. The suggested model has two goals that maximize the overall earnings of the company and customer happiness. Then, using GAMS optimization software, a large number of numerical instances are produced and solved. Using a hybrid two-level non-dominated sort genetic algorithm, the validity of the provided model has been examined for the significant difficulties. To provide some management insights, some sensitivity analysis has also been done [8] Applications of operations research in health care operation management have rapidly expanded during the last several years. However, blood is a perishable, priceless, and life-saving substance that is a precious asset to any healthcare facility. Designing a blood supply network becomes crucial as a result. A blood supply chain has certain adjustments, it should be highlighted. The goal of this research is to identify the placement of blood bank network components as well as the distribution of network components. The research takes into account demand points, testing and processing facilities, blood banks, and donor locations as parts of the supply chain. It is well recognized that demand centers like hospitals and clinics heavily rely on blood products, and that any shortage in supply might potentially cause someone's death. Thus, a transshipment sub-network between demand locations is taken into account as the final layer of the network under consideration. This research takes into account the majority of the complexities in the formulation of blood supply chain problems, including examples like blood wastage, blood product decomposition in lab settings, and transshipments between demand sites. The issue is given another objective function since, for such a crucial and life-saving supply chain, the goal would go beyond cost minimization. Therefore, the -constraint approach is used to find a Pareto solution for both objective functions. The model is then applied to a variety of problem sets to see how applicable the issue is.

DISCUSSION

The strategic planning of the supply chain to determine the price and the amount of time it takes to get products from producers and suppliers to consumers is known as supply chain network design. This guarantees the best possible use of the organisations' resources. This network's architecture may make it easier to move completed items more quickly from the raw material stage to the ready-to-consume stage. The planning and execution of supply chain activities in the most effective manner for long-term advantages is what supply chain network architecture as a whole entails. While creating a good network architecture for the supply chain, the organisations should concentrate on planning the following areas:

1. Logistics and transportation: One of the most important areas of planning is the transportation of both completed items and raw materials. This controls the whole supply chain and establishes how operational processes should be carried out. The methodical and timely transportation of commodities is supported by route planning and logistics optimization.

2. Location of storage and distribution centers: This entails positioning supply chain nodes in the proper places. In order to create a robust and effective supply chain network, it is necessary to determine the location and the ideal number of facilities. The size of the distribution centres and warehouses should also be determined by the demand.

3. Management and planning of inventories: When managing the supply chain, this shows to be one of the most challenging regions. It is important to determine the optimal quantity of goods that has to be moved and stored. This also covers the scheduling of fulfilment times and the necessary maintenance of response times.

4. Expenses and procedures for procurement: Vendor management in terms of price, lead time, and location is involved in the sourcing of goods and materials. It is necessary to determine the quantity and calibre of manufacturers and suppliers.

5. Network design's significance in the supply chain: The supply chain has established itself as the foundation of enterprises in the modern environment, particularly in the wake of COVID-19. To fulfil the ambiguous demands of the market across numerous sectors, the supply chain must be more robust and effective.

Organizations must concentrate on creating a network that can set up their supply chains in a manner that is market-driven and future-proof. This implies that they must thoroughly research topics like demand, supply, capacity, storage, and technology needs before creating and assembling the individual components. It's important to thoroughly research the expense and time needed. It's critical to pre-design the supply chain network due to the fast changing customer tastes and choices as well as the ambiguous demand for services and goods. Delivery the following day or within 24 hours is increasingly expected in the world of online shopping. A client could choose to transfer brands as a result of a delivery delay or an item's unavailability.

For a firm, the network architecture of the supply chain has enormous long-term benefits. Customer satisfaction might rise as a consequence of an effective supply chain. In platforms like e-commerce and online shopping, this might be a big benefit. The expense of the activities may be controlled and tracked. In order to produce profits, an effective network design would assist in balancing cost and income. The usage of resources may be maximized and processes can be significantly optimized. A firm may get a competitive edge with an effective network architecture. A highly optimized supply chain has grown to be a challenging objective for many firms. Companies that master supply chain management may rise to the top of their respective industries. Supply chain network design is a challenging endeavor that calls both creative thinking and meticulous planning. Manual planning may be laborious and prone to mistakes. Today's technology makes it feasible to foresee demand changes and optimize the architecture of

the supply chain network. Using tools like location intelligence and digital twins powered by AI, supply chain networks are being designed with greater accuracy.

Supply networks play a crucial but sometimes overlooked role in our daily lives. Almost everything we buy in a shop is delivered to us as a result of a supply chain, and maintaining these networks is a difficult and always changing operation.

Designing a supply chain network requires careful consideration of location intelligence. Every element of supply chain design is dependent on location data, from improved methods to assist retailers to choosing the best site for a new distribution facility to knowing how products go to their destination. We will demonstrate the value and significance of a well-planned and efficient supply chain for any organization in this article. Network architecture for the supply chain and location intelligence. Building and simulating a supply chain is the process of supply chain network design, which aims to better understand the costs and times involved in delivering items to market given the resources and locations at hand. In this procedure, it is typical to assess the following inquiries:

How can I set up my supply chain network to provide the needed service at the cheapest price?

How can I choose the best product sourcing and inventory deployment criteria to satisfy expected consumer demand given a fixed network?

How can I make the greatest use of the transportation resources I have, given a logistics network and a predetermined distribution strategy?

The ultimate objective is to build the most effective network, satisfy client demand, and guarantee the lowest cost of network service. Many of the variables and models used in this process, including your distribution centres, retail network, and potential routes to service those locations, are location-related. Even while they may not immediately seem to be affected by location, other assumptions such as the quantity of transportation resources, the estimated delivery time, and the overall route duration are also connected to location. How you plan your routes and allocate resources to various shop clusters ultimately depends heavily on the precise routes and road networks. To service these additional sites, the corporation has not yet established a new distribution facility. To understand how Publix presently supplies its shops, determine the best site for a new distribution centre, and calculate the return on investment of building a new distribution centre, we assessed the locations of Publix stores and distribution centres. The following data sources and analysis were utilised to accomplish this:

To determine the population serviced by each shop, use the Data Observatory's demographic data.

Using spatial clustering analysis, each route's logical storage clusters will be create. A route that is optimised or takes the shortest amount of time and distance between a start/stop site and a number of additional destinations. In order to comprehend the design of the present supply chain network, we: Using CARTO's clustering algorithm to identify logical groupings of stores, logical

clusters of stores were created. Then, after making some small modifications for outliers that needed to be sent to various distribution centres, we assigned these groups to the closest distribution centre. For each of the routes leaving from the distribution center, logical groups were generated using the same clustering algorithm. The most effective path from the distribution centre to each store and back to the distribution centre was determined using the optimal routing method.

This study provides us with the total driving time and distance of the journey. Following an analysis of the data, it was determined that certain routes needed to be changed to ensure that they could be finished in a single shift, or if that was not feasible, they would need to be divided into two shifts. In order to have as many routes as feasible that might be finished in one shift, we then further optimised the routes and divided some of them into smaller routes, assuming that a drop off takes 30 minutes. We will want to locate a new distribution centre somewhere in North Carolina to service these retailers and to enable further development in North Carolina, South Carolina, and Virginia after taking a look at the stores that the Dacula distribution centre serves. We chose this place after carefully examining the Statistics Observatory's job, population, and roadways data to identify a sizable city close to major highways with links across the area.

Explain the purpose of a supply chain and how supply chain choices affect a company's performance. Maximizing total supply chain excess should be the aim of a supply chain. The value created for the client less the total cost spent along the whole supply chain is known as the supply chain surplus. The entire pie for all supply chain participants expands in size when the supply chain excess is emphasised. Because they considerably affect both the income earned and the costs paid, supply chain choices have a huge effect on the success or failure of any company. Successful supply chains control the movement of goods, information, and money to provide customers a high degree of product availability at cheap prices.

2. List the three main supply chain decision stages and describe their relative importance. Depending on the time period they pertain to, supply chain choices may be classified as strategic (design), planned, or operational. The design of the supply chain is affected by strategic choices. These choices have an effect that lasts for a while.

Production plans, subcontracting, and promotion choices are examples of planning decisions that span a few months to a year. Operational choices range from minutes to days and include order fulfilment and production scheduling. Operational choices are constrained by strategic decisions, which in turn are constrained by planning decisions.

3. Describe a supply chain's cycle and push/pull viewpoints. In a supply chain cycle perspective, operations are broken down into cycles that are carried out at the intersection of two subsequent supply chain phases. Each cycle begins when one level of the supply chain places an order and ends when the order is received from the supplier stage. A push/pull supply chain perspective categorises operations based on how soon or late they occur in relation to a client order. Push operations are carried out in anticipation of consumer orders, and pull processes are carried out in reaction to a customer order.

4. Arrange a company's supply chain macro processes into categories. Depending on whether they are internal to the company or at the interface with customers or suppliers, all supply chain operations may be divided into three macro processes. The procedures that produce, receive, and monitor client orders are all included in the CRM macro process, which sits at the company-customer interface. All internal firm-wide supply chain procedures that support the planning and fulfilment of client orders are included in the ISCM macro process. The SRM macro process is made up of all supply chain procedures that are used to assess and choose suppliers so that the company may subsequently purchase products and services from them.

CONCLUSION

By mapping, modelling, and optimizing procedures to make sure that goods or services are supplied on time and efficiently, supply network design strengthens the supply chain. A supply chain's structure and network are outlined in a working model called a supply chain design, which is used to calculate the time and costs associated with getting products to market. This chapter discusses the functions of the distribution network and factors that influence the design of the distribution network.

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CHAPTER 11

NETWORK MODEL IN SUPPLY CHAIN MANAGEMENT

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Abstract:

The supply chain network design is a working model that outlines the overall structure of a supply chain to determine how long and how much it will cost to get products to market. This methodology aids a company in identifying supply chain inefficiencies and possible dangers. Supply chain network modelling is an investment that pays huge dividends. An end-to-end understanding of the linkages and trade-offs at play is necessary for the ability to strategically allocate capacity and foster flexibility in sourcing, production, and distribution. This chapter demonstrates the benefits of supply network design, producer holding and direct sending, and the network model in supply chain management.

Keywords:

Development, Network, Supply Chain Management, Supply Network, Supply Chain Network.

INTRODUCTION

The development of multi-stage stochastic optimization techniques, which are necessary for decision - making under demand, freight rate, and exchange rate uncertainty, is the core focus of supply chain network design. Here, we'll talk about the many approaches to studying uncertainty and scenario modelling.

Location of the warehouse: As businesses grow their branches into new areas, they also require new storage facilities. Here, the business is having trouble finding a warehouse. The location that has the lowest fixed expenses and operational costs while still meeting the demand is picked from among the possible options.

Design of the traffic network: As the population grows, so does the amount of traffic in cities. The traffic networks must also be expanded due to the increased demand for transportation. The main challenge is deciding which projects should be built to improve the flow inside a traffic network because the funding provided is typically constrained.

Reshoring: This phenomenon has recently become more prevalent as a result of cost increases and other factors. Restoring outsourced goods and services to their original shipping location is what this process entails. It describes the procedure for returning some or all production to its source.

Network Models: Supply chain networks offer a variety of models that aid in our understanding of the many optimization techniques used in uncertainty analysis and scenario modelling. As listed below, there are six different supply chain network models.

Producer holding and sending directly

Producer holding with in-transit merging and direct shipment (cross docking)

Distributor storage combined with delivery by package carrier

Last-mile delivery combined with distributor storage

Storage for the producer or distributor and customer pickup

With client pickup, retail storage

Producer, Distributor, and Merchant are the three main groups that the supply chain network mostly engages with. There are two possibilities, namely client pickup or door delivery. Transport occurs between the producer and distributor, distributor and merchant, and producer and merchant, for instance, if the door delivery option is chosen. The decision about the distribution system is based on the preferences of the customers.

This has an impact on both the price of the distribution plan and the demand for the product or items. One particular form of distribution network may be used to the detriment of young businesses. When it comes to the many optimization models stated above, businesses tend to merge multiple types for separate products, consumers, and usage scenarios. We shall now briefly discuss each model[1], [2].

Producer Holding and Sending Directly:

In this model, products are transported without the assistance of a merchant, directly from the starting point at the factory to the final customer's location. The retailer is the one who receives the order and requests delivery. Drop-shipping is another name for this choice, in which the goods is sent directly from the factory to the customer's address.

Producer holding with in-transit merging and direct shipment

The difference between it and pure drop-shipping or moving is that parts of the order originate from several locations and are combined into one so that the consumer receives a single delivery.

Distributor storage combined with delivery by package carrier

When package carriers are utilized to transport items from the intermediary location to the end client, this occurs because the inventory is not owned by the makers at the factories but rather by the merchants or retailers in intermediary warehouses.

Last-mile delivery combined with distributor storage

This kind happens when a store instead of using a delivery carrier delivers the goods that a customer has ordered to the customer's home. Storage by the producer or distributor for client pickup. In this case, the manufacturer's or producer's warehouse houses the inventory, but clients place their purchases online or over the phone and then show up at designated pick-up locations to pick them up.

Retail storage with customer pickup

When inventory is kept locally in retail stores, this mainly applies to instances where customers can go into the store, place an online or phone order, and pick up their purchase there.

Advantages of Supply Network Design:

Businesses can simulate and visualize their supply chains with the use of supply chain network design, or SCM network design, in order to improve them. Supply chain optimization improves service, speed to market, flexibility, and risk reduction while lowering total costs.

Significant advantages: Identifying components for simplification and potential cost savings**.** Inventory and purchasing costs are reduced**.** Reduced working capital**.** Decreased freight costs**.** Route planning to cut down on travel time and fuel expense. Reduction of supply chain variable costs and network fixed expenses (facilities, equipment)**.** Service levels and delivery timeframes are optimized for client satisfaction.Visibility of processes and costs across the supply chain network**.** Giving the full supply chain network performance insight by assessing its capabilities and costs in comparison to predetermined standards[3]. Project of research One of the most intricate supply networks is the supply chain. For engineers and industry managers, managing this complicated system has presented new obstacles. In the framework of the research initiatives, supply chain network optimization is thus crucial. In this essay, the supply chain management network for research projects in an Iranian project-based company is designed. Using a mathematical methodology, this model incorporates strategic choices across the whole life cycle of research initiatives. This model serves as a reference for managers working on research projects so they may recognize the strategic choices made by PSCM in their own businesses and work to improve and resolve them. Additionally, it provides a solid foundation for academics to develop their investigations into PSCM in future studies. The practice of "green supply chain management" (GSCM) has emerged as a means of enhancing environmental performance. Companies must enhance their GSCM processes in response to stakeholder demands, forces, and requirements. These activities include green buying, green design, product recovery, and engagement with customers and suppliers. Businesses' economic and environmental performance will improve as they promote the GSCM. As a result, GSCM assessment is crucial for every firm. Data envelopment analysis is one method that may be used to assess GSCM (DEA). The foundation of traditional data envelopment analysis (DEA) models is the idea that production is a "black box." The absence of connecting activities in these models is one of its shortcomings. In order to evaluate the GSCM in the presence of dual-role components, unwanted outputs, and ambiguous data, this research proposes a unique network DEA model. A case study illustrates how the suggested paradigm is used. A case study illustrates how the suggested paradigm may be used [4]. Providing a social network-based approach for knowledge management enhancement in multi-level supply chains created by small and medium-sized businesses is the purpose of this article (SMEs). Design, methodology, and approach: This strategy proposes and represents a supply chain knowledge network using social network analysis methodologies. Additionally, a concrete example from a preliminary case study in the construction industry is provided. Findings: By encouraging motivation and self-assurance, this idea enhances the creation of networks between organizations to share information among the businesses involved in the supply chain. Originality/value: By using this suggested model, academics and supply chain management professionals may better comprehend knowledge management procedures, especially for supply networks made up mostly of SMEs [5].

Reverse logistics and waste management are two significant, somewhat overlapping fields in scientific literature that deal with the environmentally and economically advantageous elimination of trash. Both areas research the flows of items that are thrown away after being used, among other things. In order to achieve greater integration, this study adopts an integrated perspective on reverse logistics and waste management. More particularly, it provides a succinct but comprehensive summary of the work that has been done so far using combinatorial optimization models to construct strategic networks for waste reverse supply chains. Its goal is to introduce interested readers and scholars to publications of their choice and enable them to choose alternative routes from the well-trodden ones. We specifically discuss, among other things, the following: (1) the value of environmental, social, and performance indicators in multi-objective models; (2) the possibility of including various waste reverse supply chain stakeholders in the network design model; (3) the consideration of future waste reverse supply chain developments like extended producer responsibility schemes and the circular economy and their challenges; and (4) better heuristics to deal with the increasingly complex problems that arise in the field[6].

Supply chain management (SCM) is now essential for all industrial and service businesses to achieve a competitive edge. From a management perspective, the parties' acceptance into SCM and their roles are seen as very strategic. In order to improve the performance of the whole chain, the current research offers a soft network model for SCM of small and medium-sized firms (SMEs). The conceptual model is compared, and it is clear that by using centers for manufacturing, procurement, and marking, it will cover every aspect of the supply chain. Through the integration of all chain parties, collaboration between all stakeholders based on the unity commission into the SCM model would improve the supply chain's performance and allow for continuous improvement in accordance with the 'plan, do, check, and act' (PDCA) concept. By lowering the price of the finished product, the delivery time, and the shortage, the proposed model's implementation improves key performance indicators of the supply chain. This creates a green, competitive environment for business-to-business transactions while preserving the collaborative union of SMEs as a technology-driven firm. Academic Journals from 2010[7].

This research focuses on developing a supply chain (SC) network management key processes model jointly and in depth, as well as on evaluating the relative significance of these key processes for the semiconductor industry. An interdisciplinary team with approximately 20 individuals from academia and industry conducts the collaborative design and analysis. This study's case study, an e-SCM collaboration involving the biggest semiconductor foundry in the world and the biggest assembly and testing service provider in the world, is based on the experiences of those team members. For collaborative design and analysis, this project uses fuzzy analytic hierarchy process (FAHP) and focus group technique. The end result of the design is a structured and complete key processes model (SMLR) with a total of 15 key processes divided into four dimensions: strategy and planning, manufacturing, logistics, and risk management[1]. Since they make up around half of the total weighting at their level, the weightings that come from the FAHP analysis may be used to identify the most important one dimension and four essential processes. Future SC network management project executives may use the SMLR model as a structured and complete reference model, guaranteeing that all crucial procedures are covered to prevent highly expensive failure. These managers may use the resultant weightings to determine the relative significance of these essential activities, which can

guide them in choosing how to allocate scarce resources to support the most important operations. The practices of the top three key processes in the semiconductor manufacturing industry were used to illustrate what actions can be taken to improve these processes and, as a result, benefit the entire SC network, during a second session of focus group meetings to confirm the results and further explore the managerial implications. The study's findings may act as the basis for further academic investigations in related fields [8].

The integrated supply chain management model provided in this research uses data from GPS and RFID to determine where items are located. Grouping, routing, and scheduling logistics activities are automated and optimized by the model. There are suggested optimization strategies for routes and timetables that reduce resource usage and trip time. Instantaneous and dynamic information on the logistics tasks' current processing and location state is provided by data from RFID readers and GPS devices. So that centralized logistics planners may make any required adjustments, the optimum routes and timetables are then dynamically updated and shown. Thus, the suggested method integrates discrete and continuous data to support logistics routings and scheduling and improve supply chain management. By identifying the routes or schedule segments where processing times vary, the model may address the practical issue of processing time variation.

DISCUSSION

Although they are a crucial part of our everyday lives, supply networks are often disregarded. Almost everything we purchase in a shop is a product of one of the intricate and constantly changing supply chains that must be managed. The design of the supply chain network significantly depends on location intelligence. It's a piece of technology or software that links users to other community members in order to generate possibilities that benefit all parties. A huge number of companies and their mutually beneficial alliances, in which the businesses interact with the core businesses either directly or indirectly, make up supply chains. In this network, businesses are the nodes, and their connections to one another are the links. Businesses must use more complex and worldwide supply networks to produce and distribute their products and services. In order to maintain profitability, provide excellent customer service, and lower the risk of disruption in today's hypercompetitive business climate, organizations must continually develop and manage effective supply chains.

These supply networks are renowned for their complexity and underlying unpredictability. Simulating such supply systems is a complicated and difficult research project given the stochastic character of the majority of supply chains. This problem is growing more pressing as a result of recent advancements in communications, notably Internet technologies, which promise to connect suppliers and consumers in a single, integrated network of information. This might greatly enhance operational effectiveness and decision-making. However, this assurance depends on the creation of a suitable supply chain modelling methodology. The supply chain network, which starts with the sourcing of raw materials and continues through production, storage, distribution, and ultimately retail sales, is in charge of controlling the flow of materials, information, and value. This network's complexity is similar to that of other kinds of networks in that it has a small world, sparse connections, and a large size. In a supply chain network, which is multi-hierarchical and includes a common set of companies and services at each tier, both suppliers and demanders are participating.

Supply chain network adaptation to external and internal rivalry and collaboration is a continuous activity. There will be a rise in the proportion of companies with a significant competitive advantage. On the other side, in order to prevent the supply chain's expansion, weaker participants may be removed and replaced by new ones. One of two methods that are presently in use may be used to study the development of the supply chain. The first approach analyses the development of competition-cooperation in the supply chain using game theory. This approach is only used in the present research to examine supply networks with a straightforward structure and a limited number of members. The supply chains of today are so interwoven that this method is no longer valid. Creating models based on supply chain intrinsic properties and network topology structure is another technique to understand the evolution rule. The first evolution model was created based on the BA evolution model of scale-free networks, which adheres to the principles of preferred choice and dynamic development. On the other hand, this evolution model has a network topology that is significantly unlike from actual supply chain networks. Further investigation led to the inclusion of supply network information to the initial evolution model.

An industry's supply chain (SC), which includes the network of suppliers, manufacturers, manufacturing facilities, distribution hubs, and warehouses, is essential to its success. Supply chains are used to obtain raw resources, convert them into completed goods, distribute them to clients, and deliver them. SC is also known as a logistics network, in which a number of processes are linked, then additional charges and associated activities are added on. The majority of industries are compelled to make SC investments in order to increase network effectiveness and efficiency. Supply chain theory has been actually used throughout history, from the Silk Road to the enduring instances of human propensity for armed conflict. Prior to the dawn of capitalism, logistical networks were primarily used by members of the armed forces, and activities like transportation, maintenance, and procurement were carried out in response to the demands of the military for resources and facilities. People began to recognize the importance of logistics and increased their investment in the creation of effective networks for the SC as a result of the massive fluctuating amounts of transporting people and commodities to different areas and under the scarcity of resources, labor, or knowledge.

The design of a supply chain network involves two levels of decision-making; the first level is concerned with deciding how the network should be configured by maximizing the number of facilities and choosing the ideal network locations. As they are made at a strategic level, these choices are exceedingly costly to alter. It was discovered that significant expenditures are often required to make these choices since they have long-term consequences on SC performance and are thus extremely difficult to modify. Another category is second-level choices, which provide information on how the supply chain functions by requiring the allocation of facilities and material flows and helping to create transportation plans for the SC. These choices are based on instantaneous judgments made for a brief period of time at the operational or tactical level. Supply chain network design refers to the first-level choices that have a significant influence on an organization's overall SC performance (SCND). Harrison estimates the cost effect of SCM on a company at up to 30%, with SCND choices accounting for 80% of the overall SC cost. In SCND, modelling and designing supply chain processes are taken into consideration in order to comprehend and analyses the time and costs necessary to transform raw materials into completed goods. A reliable management solution for supply chain network planning is offered by SCND. A sustainable supply chain network design (SSCND) tries to simulate the ideal supply chain

network architecture that enables a business to optimize its long-term advantages in the economic, environmental, and social pillars of sustainability. Sustainable supply chains (SSCs) are broadly defined in the literature as an interaction between different firms that offers significant benefits for the three pillars of sustainability (i.e., the economic, environmental, and social aspects) and establishes a long-term engagement to procurement and SCM in the twenty-first century. These three sustainability pillars determine how well an industry performs. The paradigm for sustainable development has advanced as a consequence of these concerns. A sustainable supply chain network design (SSCND) seeks to simulate the ideal supply chain network architecture that enables the company to optimize long-term advantages in terms of all three pillars, namely economic, environmental, and social factors.

Massive emissions of greenhouse gases (GHG) from the use of fossil fuels to meet the energy needs of industrial sectors, primarily transportation, have had a severe impact on the environment and contributed to global warming. It has been one of the most important issues facing people now and in recent decades. Numerous studies focusing on methods to lessen the pollution produced by SCs from different sectors have been done. Sustainability is the capacity of a corporation to make SC choices without negatively affecting the future conditions of the three aspects, namely the environment, society, and the stability of business (economic). These three sustainability pillars determine how well an industry performs. The paradigm for sustainable development has advanced as a consequence of these concerns. According to the UN, sustainable development is defined as meeting current needs without compromising the ability of future generations to meet their own needs. In order to solve the sustainability issues, several nations work to reduce GHG emissions via effective Sustainable SCs.

The supply chain network is made up of a sizable number of businesses and their collaborative relationships, in which the businesses either directly or indirectly interact with the core businesses. Businesses act as nodes in such a network, while relationships between them defined as supply-demand relationships in this work act as connections. The supply chain network with manufacturers at its center, regulates the movement of materials, information, and value from the process of purchasing raw materials, through the processes of processing semi-finished products, manufacturing, warehousing, and distribution, and finally to the retail process that sells products to customer. It has many traits with other complex networks, including its size, sparse connections, tiny world, and lack of scale, dynamic nature, self-similarity, and superfamily. The most distinctive aspect of a supply chain network is its multi-hierarchical structure, in which organisations may be on both the demand- and supply-sides and operate in both directions within the same layer. The supply chain network, however, is always changing to accommodate both internal rivalry and collaboration and external market demand. As a result, businesses with high levels of competition will become stronger and attract more partners. On the other hand, weaker businesses could be shut down and replaced by newcomers if they prevent the growth of the supply chain.

We can better manage and regulate the supply chain network by being aware of its development law. The supply chain is an example of a typical complex adaptive system, according to Surya D. Pathak. He looked at the dynamic development and expansion of the supply and demand network and debated whether there are any basic laws that govern it. Wu conducted a quantitative analysis of the scale-free characteristic of evolving genuine supply chain networks. The complexity of the supply chain, according to Dirk Helbing, cannot be described by conventional algorithms or models, and he came to the conclusion that the topology and macro

nature of the network that makes up the supply chain have a direct impact on its micro modifications. In addition to the internal competition-cooperation that is crucial to progress, supply chain rivalries also arise. For instance, two supply chains that provide a certain sort of product may compete with one another for a small market share. Another example is when a business provides raw materials to several supply chains, which may also result in rivalry amongst them. As a result, supply chain contests are crucial for their growth. We comprehend that the basis and premise for researching the rivalry among various supply chain systems is the study of the influence mechanisms concerning internal competition-cooperation to the development of the supply chain. Our study focuses on the impact of competition and collaboration on the development of a single supply chain as a result.

There are currently two approaches for examining supply chain evolution. The first approach uses game theory to examine the development of the competition-cooperation law among supply chain companie. The study of supply chains with simple structures and few firms is the sole application of this technology being studied. This approach is no longer useful for supply chains that are complicated. Building evolution models in accordance with the network topology structure and intrinsic characteristics of the supply chain is the second way to comprehend the evolution rule. The oldest evolution model, which adheres to the principles of preferred choice and dynamic development, is based on the BA evolution model of scale-free networks. However, the network architectures produced by such an evolution model are quite unlike from actual supply chain networks. As a result, further research added some unique supply chain information to the original evolution model.

Applied the idea of preferred choice to make up for the missing edge produced by the loss of nodes in light of the deletion of companies by randomly deleting nodes. Ding *et al.* developed an evolution model that takes into account the influence generated by individual choice behavior of business nodes since the expansion rate of the supply chain scale is heterogeneous and the network topological structure would be disrupted by the addition of new nodes. On examine the development of the supply chain network, they employed the theory of weighted networks, in which the weights of the edge indicate the transaction costs among the enterprise nodes. This model, however, overlooks the influence of transaction cost to the link between two nodes. In order to build a layered weighted supply chain network model based on preferential attachment measured by the combination of multi-attribute parametersinto account the entire macroscopic behavior of supply chains networks. They also examined the growth evolving rule of the birth, decline, and exit of enterprise nodes. A five-level model of the local world network [9]. The multi-local world theory and the BA model served as the framework for this model, which also included the reality of network node formation and exit mechanisms. The networks created by this model include topological structures that resemble actual supply chains. The distance between the two enterprise nodes in the evolution model was described by as the transaction risk in order to quantify the risk impact on the supply chain network. In the actual clustered supply chain network, according to Fu et al, the route length between two business nodes also determines the rule of preference choice. Cao and coworkers also had a similar point of view. According to their research, weight refers to the mutual benefits of collaboration between two businesses. A topological supply network model that incorporates the repeating prisoner's dilemma game. According to the findings, diverse structures aid in fostering collaboration, and strategy reward and competitive pressure also play a part in how cooperation develops.

Although the development of supply chain networks has been extensively explored, there are significant shortcomings in the current models. First off, evolution models of complex networks constitute the foundation for the majority of contemporary supply chain evolution models. However, there are significant differences between the topologies of a common network and an actual supply chain. A particular kind of hierarchical network is the supply chain network. The nodes on the same layer do not form a partnership since the edge indicates the link between supply and demand. Despite the fact that various studies have studied hierarchical organisation, business collaboration only occurs within neighbouring hierarchies and not across layers. Second, only a small number of studies have examined the effects of external market demand on supply chain growth. In actuality, there is a strong relationship between demand on the external market and supply chain growth. When the demand on the external market changes, the supply chain will modify itself to accommodate the new need. Third, earlier evolution models did not take into account the three phases of the development process or the supply chain flow balance. Supply chain growth adheres to the same principle of survival of the fittest as ecosystems, which means that the network scale obeys the Logistic function. Additionally, the supply and demand throughout the whole network of the supply chain are moderate. The conservative will be broken when the enterprise (or partnership) inclusion (or deletion) takes place. The whole system and people will soon reestablish a new equilibrium for those seeking advantages. The network flow balance should thus also be taken into account.

CONCLUSION

The network model in supply chain management, producer holding and sending directly, and benefits of supply network design are demonstrated in this chapter. Supply chain networks are fueled by internal rivalry and collaboration as well as external market demand. A building evolution model may be used to comprehend and manage the supply chain management system. In order to address the inadequacies of prior models, which are unable to accurately describe the law of supply chain growth, we introduce a unique evolutionary model under external market requirements and internal rivalry and collaboration. The many institutional and operational problems that SCSs face make it necessary to have an integrated perspective of systemic risks and their impact on SCS performance and behavior.

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CHAPTER 12

ROLE OF IT IN SUPPLY CHAIN MANAGEMENT

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Abstract:

IT's job in supply chain management is to streamline operations and avoid bottlenecks. Particularly in manufacturing, businesses are getting closer to achieving on-time procurement, reduced inventory, and improved efficiency.The following are the primary advantages of electronic data exchange, tools for enterprise resource planning (ERP), supply chain management, and the role of IT, all of which are covered in this chapter.

Keywords:

Information,IT, Supply Chain Management, Technology.

INTRODUCTION

Companies that choose to take part in supply chain management efforts agree to play a certain role. They both agree that this cooperative effort will benefit all parties involved in the supply chain, including themselves. Here, power is the main problem. Power has shifted from manufacturers to retailers during the past 20 years. Retailers have a special status when it comes to supply chain information access. They use technology to rise to the position of prominence. There are three key advantages of improving inter organizational information systems for the supply chain. These are:

Cost reduction: As a result of technological advancements, all products are now readily available with a variety of offers and discounts. As a result, product costs are decreased.

Productivity: It has increased thanks to the development of new tools and software as a result of the development of information technology. Because of this, productivity is considerably simpler and takes less time.

Enhancement and product/market strategies: Not only have technologies advanced significantly, but also the market as a whole. New marketing techniques are developed to entice clients, and fresh concepts are tested to enhance the product.

Information technology could be considered a key component of supply chain management. The introduction of new products in a matter of seconds thanks to technological advancements has increased consumer desire for them. Let's take a quick look at how information technology affects supply chain management. In order to advance and maintain supply chain information systems, both the software and hardware components must be taken into account. The input/output (I/O) components of a computer, such as the screen, printer, mouse, and storage media, make up the hardware. The complete system and application program utilized for

transaction processing, management control, decision-making, and strategy planning are included in the software component. Here, about several key pieces of hardware and software that are used in SCM. That are briefed below:

Electronic Commerce: A wide range of tools and processes are utilised in electronic commerce to conduct business in a paperless setting. Therefore, it includes shared databases, email, electronic fund transfers, publishing, image processing, electronic bulletin boards, and magnetic/optical data capture.Electronic commerce enables businesses to automate the exchange of records, documents, data, and information between suppliers and clients, making communication much simpler, less expensive, and more efficient.

Interchange of Electronic Data: Electronic Data Interchange (EDI) is the process of exchanging business documents between computers in a common format. In place of the conventional methods of mail, courier, and fax, it shows both how it is possible and how it is done when two businesses exchange information.

The following are the main benefits of Electronic Data Interchange:

1. Instant information processing
2. Flexible customer service
3. Low administrative burden High output
4. Expediting and advanced tracing
5. Cost effectiveness
6. Competitive advantage
7. Advance payment

By modifying technologies to facilitate the real-time sharing of accurate demand and supply information, Electronic Data Interchange supply chain partners can eliminate the distortion and falsehood in supply and demand information.

Barcode scan: The use of barcode scanners is evident at supermarket checkout desks. The manufacturer's name and the name of the product are both listed in this code. The tracking of moving objects, such as components in PC assembly processes and automobiles in assembly facilities, is another useful use for barcode scanners.

Data Warehouse: Data warehouses are stores that contain all of the databases. It is a centralized database that is maintained separately from a company's production system database.

Many businesses manage numerous databases. Instead than focusing on specific business procedures, it centers on informational topics. Data warehouses contain conveniently accessible, time-sensitive data. Data warehouses may also be used to store historical data.

Tools for Enterprise Resource Planning (ERP)

The ERP system serves as the foundation for many IT systems. Baan, SAP, and PeopleSoft are a few examples of ERP tools. Many businesses today use ERP systems as their primary processing tool. They gather the information and reduce the human processes and tasks involved in handling financial, inventory, and customer order data. ERP systems have a high level of integration, which is made possible by using a single data model correctly, enhancing communication about what the shared data means, and creating a set of rules for data access. May claim that as technology develops, the world is getting smaller. In a similar vein, consumer expectations are

rising. Additionally, businesses are more vulnerable to unstable environments. A business can only survive in this competitive market if it acknowledges the need to broaden the traditional supply chain integration outside its borders.

The supply chain's strategic and technological interventions have a significant impact on anticipating a company's buy and sell features. A business should make every effort to make the most of the internet's potential with a clear vision, solid planning, and technological understanding. Both enhanced supply chain management and increased competitiveness depend on this. Innovations like the World Wide Web, electronic commerce, and Internet technology have altered how businesses operate. These businesses need to understand how technology may help them collaborate with their clients. A new wave of SCM application has been released by IT. The Internet and other networking connections study historical patterns and performance to determine how much merchandise should be produced, as well as the most efficient and effective ways to store it or ship it to retailers.

LITERATURE REVIEW

Heddoun Asmae and Benrrezzouq Rhizlane [1] The use of logistics information technology (LIC) in supply chain management operations is crucial. Businesses globally spent $300 billion on LIC in 2015, an increase of 1.8% and 3.8% over 2016 and 2017, respectively. If the (LIC) does not function as anticipated, firms running the risk of declining financial performance. In reality, there is conflicting data, with some businesses profiting from (LIC) investments while others do not. The effect of LIC on company performance is unknown despite extensive study on the application of information technology in a supply chain management framework. In instance, inconsistent findings have been published in the literature about the connection between the LIC and the success of the firm. Therefore, the goal of our paper is to examine the functions of information technologies in SCM and to draw attention to this crucial field of study. We discover that raising a company's performance is not always a result of the LIC. Particularly, LIC has a number of traits, and each trait is connected to certain performance measures.

Saibal Kumar Saha and Ajeya Jha [2] Supply Chain Administration SCM is a crucial component of any organisation. A well-coordinated SCM may increase corporate productivity and aid in cost cutting. Since information technology (IT) is extensively employed in all industries, SCM may greatly profit from its utilisation. This article evaluates many articles in the area and identifies areas for more investigation. This article's goal is to evaluate the literature on the impact of IT on supply chain management (SCM), with a specific emphasis on the pharmaceutical sector, and identify any gaps that may exist from the perspectives of practitioners and scholars. The efficiency of SCM has increased thanks in large part to IT, according to the article. But the secret to a successful SCM is its effective implementation and cooperation with other businesses. Gaps within each category have been noted.

Priyanka Mansing Salunkhe [3] The globe and every element of company operations have transformed because of the information technology revolution. There are several potential alternate options for successfully managing the supply chain as a consequence of information technology improvements. The purpose of supply chain management is information-driven. Supply chain management supported by information technology will provide a company a

competitive edge over its rivals in the market. IT is important to the decision-making process. Within the supply chain, IT fosters collaboration and coordination. The overview of information technology for efficient supply chain management, software-focused supply chain features, and IT technologies utilised in IT enabled supply chain management.

Vojko Potocan and Zlatko Nedelko [4] The successful management of today's intricate supply chains is said to require the use of information technology (IT). Despite the widely accepted significance of using IT in supply chain management (SCM), there aren't many empirical studies evaluating its use in this setting. This research proposes a taxonomy of the manner in which organisations utilise IT in SCM and investigates the causes behind these distinct usage types based on actual data from 16 Finnish industrial and service companies. The usage of IT for SCM may be categorised into three categories, according to the research's findings: transaction processing, supply chain planning and cooperation, and order tracking and delivery coordination. The results further imply that these three IT-related SCM applications have different driving forces Key.Amineh A. Khaddam *et al.* [5] This study aims to investigate the indirect effects of competitive advantage (CA) in its five dimensions—cost, quality, delivery time, flexibility, and creativity commitment—on the supply chain management (SCM) in its three dimensions—relationships with suppliers, relationships with intermediaries and distributors, and relationship with customers. Information technology (IT) will be used as a mediator in this analysis. 250 questionnaires were also given out at the Halawani Industrial Company. There were 226 questionnaires examined. To test the hypotheses, the Statistical Package for Social Sciences (SPSS) was used. The findings of the partial study indicate that connections with suppliers and customers both had an effect on IT, but ties with distributors and intermediates had no direct impact on CA but supported SCM's ability to have an indirect impact. The study's most significant finding was the need to regularly and continually assess basic capabilities in order to change the essential assets, which serve as the foundation for core competencies, including the prerequisites and circumstances for strategic thinking and leadership abilities. Additionally, the research offers a knowledge inventory on the reality of SCM and its function in attaining CA via IT, which adds to the general and Jordanian libraries' wealth of information on the topic.

Kenneth M. Mathu [6] Backdrop: The study's background examined the recent development of supply chain management, which brought about technology that fosters information exchange both inside and across businesses. The information flow enables the coordination of corporate operations, including, among others, relationship-building and supply chain management. The study's goal was to determine how supplier-customer information sharing was improved by the use of information technology (IT) in South African small and medium-sized enterprises (SMEs). Setting: In the Gauteng Province of South Africa, interviews were performed with samples of SMEs that included owner-managers from both food and general trade SMEs. Methods: A non-probability sampling strategy was explored together with a qualitative research approach. Findings: Based on better interaction via supply chain cooperation and integration, the results showed that IT application in South African SMEs promoted supplier-customer information-sharing. The study's conclusion emphasised how improved supplier-customer information-sharing resulted from IT applications in businesses as reported by South African SMEs.

All facets of life now place a high value on sustainability, and the supply chain is vital to both production and logistics. Information technology is continually transforming supply chain management (SCM) (IT). Reviewing and debating the impact of information technology-based SCM on sustainability is the goal of this research. By gathering author-anchored keywords from peer-reviewed works on IT-based supply chain management, this study undertook a methodical evaluation of the literature. Social network analysis was used to examine a total of 1264 articles and 2575 keywords from eleven supply chain-related journals. Ten research hot topics were found on a knowledge map[7]–[9]. A sustainable supply chain management (SSCM) model is also created in order to help researchers better understand the topical and structural implications of IT-based SCM as well as to contribute to the development of a cogent and rigorous body of theories that are pertinent to academics as well as supply chain and logistics managers who are interested in SSCM.

DISCUSSION

Every organisation is fighting for survival in the cutthroat business environment of today. An organisation cannot meet customer and market demands through traditional supply chain management. The supply chain is no longer what it was before the IT revolution. IT enables a company to have a clever and reliable supply chain. The difficulty is in generating economic value through dynamic organisations, new ideas, and the use of tactical tools. The Indian supply chain industry is still in its infancy but has come to understand the importance of information technology. The use of information technology significantly improves the performance of supply chain drivers. Information technology is the application of cross-organizational information processing and/or information exchange systems. For any organisation, there is a growing demand for fully integrated supply chain management solutions that include all of the functionality of network strategy, supply chain configuration, demand planning, transportation, and warehouse management systems. The management of a network of connected businesses that are ultimately responsible for providing the product and service packages that end users need is known as supply chain management. Information, money, and the flow of goods are all part of supply chain management. The main goal of the supply chain is to increase profitability, and IT aids in this effort. Depending on the time period during which decisions are applied, the supply chain decision phase can be classified as design, planning, or operational.

The effects of IT on businesses: The influence of information systems on company operations in Information systems: Foundations of e-business. Employee access to the data kept in them was initially restricted. Data storage has grown increasingly commonplace inside corporations as technology has developed. Employees can now easily access information and information systems thanks to a network of PCs, which was simply not possible ten years ago. Information flow in supply chain networks was time-consuming and error-prone in the era of paper-based transactions and communication. Through the use of IT applications in their supply chain networks, organizations have begun to change the way they communicate, implement technology, and handle a wider variety of business transactions as a result of globalization. Supply chain management (SCM) is an integrated and complex network concept that dates back to the 1950s. It describes the collection of all processes that begin with the acquisition of raw

materials from manufacturers or producers and end with the delivery of the finished product to consumers. Data complexity has increased, which has increased uncertainty risk in supply chains, which has increased the vulnerability of electronic risks (e-risks). In order to achieve the goals of supply chain management, the upstream and downstream integration of the supply chain network is a fundamental requirement. The IT-enabled SCM can manage the flow of information with important business processes, materials, and money both inside and outside of networks, and it helps to increase firm profits by enhancing quality and lowering coordination costs and transaction risks.

The administration of a network of related companies that ultimately provides the product and service bundles needed by end consumers is known as supply chain management (SCM). In order to create integrated and coordinated supply chains for effective supply chain management, the supply chain drivers can cooperate by sharing information among supply chain networks. Because information provides processes for executing transactions and creates opportunities for decision makers when they need it and in the format they need, it also improves performance and lowers risks in supply chains. IT, which consists of hardware and software programs, plays a part in this. In order to meet the number and quality of goods, IT is also crucial in integrating suppliers, manufacturers, distributors, and consumers. By utilizing SCM effectively, businesses can gather crucial data along the entire supply chain and respond quickly to any predictable market changes, giving them a competitive advantage. The goals of IT in SCM are to provide information availability and visibility, enable a single point of contact for data, enable decisions based on complete supply chain information, and enable collaboration with partners. The functional roles of IT in SCM have been identified as Decision Support, Collaboration, and Transaction Execution.

IT systems with data integrity, real-time accessibility, information visibility, information processing capability, and business process standardization are anticipated to improve supply and demand matching among supply chain participants and provide a great foundation for integrating with external partners in the supply chain. Consistent information technology use in the supply chain increases the risk of cybercrime, including "computer-assisted" crimes like hacking and phishing as well as "computer-focused" crimes like hate crimes and telemarketing/internet fraud. Computer crime, computer-related crime, computer misuse, cybercrime, digital crime, e-crime, internet crime, online crime, etc. are common terms for crimes involving computers. As a result, IT is seen as a crucial need for supply chain management.

In SCM, IT plays a crucial role in the importance of IT in supply chain management (SCM) cannot be overstated. IT offers the tools necessary to gather pertinent data, deconstruct it for accurate analysis, and apply it to the supply chain for optimum performance. Data is essential to the operation of the supply chain, primarily because it gives the supply chain managers a foundation upon which to make decisions. Information that is current or nearly current is essential for effective supply chain management. Decision-makers may plan, manage, and adapt processes to accomplish objectives in procurement, inventories, manufacturing, etc. with knowledge of the many supply chain phases.

In the last two decades, business processes have been digitalized, and doing so is now required rather than an option. Why not IT combines multiple supply chain procedures carried out by many businesses. It expedites business operations and avoids bottlenecks. Businesses, particularly those in manufacturing, are getting closer to achieving on-time procurement, reduced inventory, and improved efficiency. IT enables businesses in the supply chain to satisfy customer needs. The core principles of supply chain management revolve around creating the ideal product in the ideal quantity and delivering it to the ideal location at the ideal moment. Although it seems easy, it can easily become challenging. The supplies are the first link in the supply chain. Manufacturers and suppliers can work more effectively together and prevent production delays caused by insufficient raw materials with the help of dependable supply chain software that enables real-time information sharing. Normally, suppliers and manufacturers start business dealings, but if you're a supplier, you may keep an eye on your customers' stock levels, anticipate future demand, and make sure you're prepared to fill requests for raw materials. In order to make wise decisions in areas like partnership and contract management, suppliers can also use historical data.

Companies must be creative and adaptable in the age of globalization to suit consumer needs. Organizational capabilities may lead to qualification in efficiency and flexibility. Supply chain management is essential for boosting the marketing team's efforts. The primary challenge in supply chain is figuring out how to complete this integration effectively. Business management has evolved, therefore we will only provide guidance to businesses on how to make the most use of information with the aid of supply chain management. The ability of management to ensure that a company will fully benefit from their information is crucial in the modern era of fierce competition. SCM in business refers to the movement of raw materials from the point of production to the point of consumption in addition to the flow of products and services. According to how it has been defined, supply-chain management includes all of the tasks involved in getting products from one place to the next. This is primarily accomplished by maintaining tighter control over internal stock, internal distribution, sales, and vendor stock. Every business has found information technology to be highly beneficial, and supply chain management is no exception. IT provides a summary of all business operations. IT makes the supply chain visible to management, which helps the business perform better. IT's primary responsibility is to use cost-effective data to streamline transactions between supply chain partners.

Supply Chain Management and the Role of ITIT will be crucial in today's modern world in every sector, but supply chain management will be especially important. IT will be used in a wide range of industries, including decision support, collaboration, and transaction execution. Companies can improve supply chain performance visibility with the aid of IT, giving us more control over our operations and helping us to stay one step ahead of the competition. Your company will be able to run more effectively thanks to IT, which will also help you save money on a variety of operational costs. Additionally, you may significantly improve customer satisfaction and retention via a more reliable and effective supply chain. Here are just a few strategies for incorporating cutting-edge technologies into your company's business plan and enhancing supply chain management.

Tracking and Shipping

Companies can create simple supply processes and reduce shipping issues with the aid of modern technologies and internet-based software. We have the ability to relate every element of their supply chain in one location thanks to software like Flash View. We will be able to digitize all of our data using the software, including our inventory, tracking options, electronic invoices, etc. We can quickly cut down on the time spent shipping, receiving, tracking, and preparing order data with the use of IT in supply chain management, which would readily save the company's time and money. Flash views make it simple for customers to have a positive experience while being able to monitor the status of their orders. Nowadays, having technology like Flash View is advantageous to both the business and the customer.

Social Media Usage

Every business uses a social networking site as a well-known tool to increase its market share. With over 288 million Twitter users and 1.23 billion Facebook users combined, there is a significant opportunity for business visibility to increase quickly. All 400 businesses rely on social media for more than 70% of their product marketing. According to social media, businesses will plan their supply chain management and marketing strategies. With the use of social media, businesses can more easily interact with their consumers, raise brand awareness, learn about client demands, create cost-effective goods, and save other costs, all of which will help them improve overall productivity. Social media will help businesses interact with customers more easily, learn about their feedback, and provide a delivery schedule for their products as well as other updates.

Make Supply Chain Simpler

A company's supply chain may be made simpler with the use of IT since technology makes it simple to gather information about delivery schedules and weather forecasts, protecting the business from client losses. IT is typically used by businesses to choose their delivery area, ensuring that customers have no trouble picking up their orders. They can easily pick up their order on time or early. While it comes to manufacturing, businesses usually choose locations where obtaining raw materials takes the least amount of time. This allows them to more easily control their supply chain both during production and when delivering completed items.

Limitations

Traceability: Recent incidents involving food safety have shown that Indian fast food suppliers like KFC, Dominos, and Pizza Hut lack the necessary tools to track down customer orders. Similar to supply chain visibility, it is extremely challenging to quickly and effectively trace materials back through the supply chain due to global and complex supply chains.

Complexity: When a company is trying to cut costs, the supply chain can become very complicated, resulting in a complex web of international third parties. When this happens, it can be very difficult for the company to track and manage the supply chain, which leads to a number of other issues.

Performance of Suppliers: Suppliers have strict deadlines for deliveries and a freeze on prices, which prevents them from lowering the price of raw materials, which is bad for businesses. In such instance, the business does not provide the need in line with the demand. The management of the supply chain may sometimes be impacted by supplier performance.

Natural disasters: Because of global warming, there is also some ambiguity regarding weather patterns and weather events. Typhoons, floods, earthquakes, and volcanoes are examples of natural disasters that have a negative impact on both location and duration. It will cause issues for both the business and the customers.

Technology: In the present day, technology will readily enhance the performance of the supply chain, but regularly updated technology will increase costs. This was detrimental to the business. Because no one has up-to-date understanding of technology, if technology cannot be handled or operated effectively, it might be the worst difficulty the organisation has ever faced.

IT problems and cyber risks will be discussed in relation to supply chain management. Cyber risks, however, will also be a major concern for every company. Supply chains depend on the integrity and upstream and downstream flow of information in the value chain. Cyber-attacks are a persistent threat that can lead to the loss of commercial data, the exposure of stolen confidential information, and the temporary suspension of business operations.

The successful management of today's intricate supply chains is said to require the use of information technology (IT). In supply chain networks, the exponential growth of information technology has significantly replaced paper-based communication with electronic communication, posing a serious risk of cybercrime (e-risk) through unauthorized or illegal access via physical or virtual intrusion to a computer or computer system or computer network. Criminals may engage in illegal supply chain network access denial, data theft, data manipulation, and illegal access to confidential data. In supply chain networks, they may also carry out fraudulent activities with the aid of IT, which can also be used to stop them. Barcodes are a time and money saver that eliminate human error, reduce paperwork, and enhance customer service; however, only supply chain partners can use them. Better data integrity makes it possible to make judgments based on current, correct data, which enhances the administration of products and categories. By using automated replenishment or vendor-managed inventory, bar code technology makes it possible for the right product to always be in the right place at the right time. Recently, organizations in the public and private sectors were required to use radio frequency identification (RFID) technology to identify their suppliers. The Electronic Product Code (EPC), a global standard for RFID, and other technologies that provide insight into the coexistence of barcodes and RFID have increased their significance in reducing e-risks.

In comparison to symmetric cryptography, asymmetric cryptography still necessitates significantly larger RFID chips. The 1990s saw EDI as the burgeoning business technology. Loss of integrity, loss of confidentiality and non-availability are the three main dangers associated with EDI messages. Vendors of ERP software make claims about how comprehensive and industry-specific their software solutions are. In reality, these packages don't support a lot of business processes, necessitating frequent upgrades. As a result, many organizations are

compelled to maintain a few legacy systems and some non-automated processes. The organizations are concerned about whether the implemented package will continue to function. However, business data ware and intelligences were integrated with various business modules via the use of ERP, such as SAP. Even in contexts with very high traffic, its new solution SAP HANA is particularly helpful in stopping fraudulent actions. The Internet not only allows for virtual communication, but it also opens up the possibility of online commerce with benefits for both customers and suppliers in global supply chain networks. Online supply chain management generates e-risks such as hacking, the spread of malicious software (Malware), theft of internet time/identity theft, cybersquatting (the act of registering a domain name fraudulently with the intention of selling it to the rightful owner of the name at a premium), privacy violation, cyber terrorism, etc. With the caveat that an Excel sheet can only process one million rows or records of data, Microsoft Excel still has a lot of powerful features that make it easy to detect and stop fraud in supply chains. According to the research, the use of IT in SCM seems to have a little influence in decision-making and in lowering e-risks via supply chain management. In the field of SCM, high performance and cloud computing technologies have begun to emerge, assisting in the provision of transparency and visibility in supply chains. It is anticipated that this emerging technology would bring about revolutionary advances in the performance and SCM risk-prevention fields. In a similar manner, next-generation Internet links disparate computing devices to produce network traffic that is produced by automated objects from public sectors to everyday human activity rather than by human intervention. Better supply chain management may be facilitated by IT systems with service-oriented architecture and web service standards, which are anticipated in the future.

CONCLUSION

Three categories of IT use transaction processing, supply chain planning and collaboration, and order tracking and delivery coordination were used to study the use of IT for SCM. Additionally, the motivations for these various IT use types were looked at. The three IT use categories that have been suggested accurately reflect the roles that IT plays in SCM based on the empirical data that was gathered for this study. The categorization clarifies this hotly debated subject and offers a starting point for future study on the application of IT in SCM.

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CHAPTER 13

BLOCK CHAIN'S ROLES IN SUPPLY CHAIN MANAGEMENT

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Abstract:

Supply chain businesses may use block chain to log production modifications to a single shared ledger, providing total data visibility and a single source of truth. Companies may check on a product's status and location at any moment since transactions are constantly time-stamped and current. Companies can track all kinds of transactions more securely and transparently thanks to block chain technology. The effect on the supply chain function might be enormous. Businesses may use block chain to track a product's history from its place of origin to its present location. The time delays, additional expenses, and human error that are usually connected to transactions might be significantly reduced with the use of this potent technology if parties working together on a single shared platform. The danger of fraud is also decreased by fewer middlemen in the supply chain. Finally, thorough records help firms to identify the source of fraud wherever it happens.

Keywords: Block chain, Product, Supply Chain Management, Technology.

INTRODUCTION

Supply chains' potential increases exponentially with the use of blockchain technology. Just considering the concept of blockchain will make it clear how current supply chains can expand and get better. You should imagine the blockchain as a very huge database in order to better grasp how it operates. The blockchain, however, is not governed by anybody or anything, unlike conventional databases. However, the blockchain can only be changed or updated if the majority of its users consent to the change. The blockchain can therefore simplify processes while ensuring that everyone has an equal share of rights, in addition to its ability to manage large amounts of data.The main goal of supply chain management is to move work-in-progress inventory—raw materials from the point of origin to the manufacturing point—and ultimately to the consumer and build brand loyalty at the lowest possible cost. To ensure that the product reaches consumers in a timely manner, this process must be sufficient and adhere to the schedule. On the other hand, the Blockchain theory describes a distributed digital record that is in crypto currency and may be used for payments, agreement exchange, tracking, and smart contracts. The blocks that make up the blockchain include records of the transactions.

Management of the Supply Chain with Block chain: Block chain has the potential to be the digital supply chain's skeleton. Customers and companies may really trace their products from the time of pickup to the moment they reach the final consumer. Blockchain contains a digital

ledger that is permanently stored and is highly secure to share with parties and conduct transactions on. Additionally, this lowers tracking costs, fraud, and mistakes. Blockchain was first used in financial services to facilitate quick and secure trade agreements and payments. Other sectors, like consumer products and retail, are now looking at ways to use block chain technologies.

Applications of Blockchain in Automotive Suppliers' Supply Chain Payments: If a company has a global supply chain, blockchain can be a very simple approach. The Australian automaker Tomcar uses bitcoin to pay its suppliers. Three additional partners from Taiwan and Israel have also agreed to use this mode for their automobiles.

Tracing the Meat/Food: Walmart utilizes blockchain to monitor its products to the final customer in the food market. Walmart tracks the pork meat it imports from China, where blockchain records the meat's journey from the time an order is placed to the day it is sold to a customer are kept. The tracking feature allows the investigators to identify and eliminate the factories that produce the origins of food-borne illnesses. The blockchain is also used by Nestle, Unilever, and Tyson for related reasons.

Checking the cold chain: Pharmaceutical and food manufacturers must store their goods in cold or other special conditions. Blockchain assists in this area by recording the humidity, temperature, vibration, and other parameters and storing those values on a permanent, unchangeable ledger. All participants in the blockchain will be informed if the storage condition differs from what has been agreed. A smart contract enters the picture to remedy the situation in this case.

Microgrids Powered by Solar: Smart contracts are used in the solar business to distribute surplus electricity. An program called Trans active Grid is part of the blockchain and is used to track and transfer energy. Ethereum serves as the operating system for this program because it facilitates the creation of various types of smart contracts. This reduces expense and pollution while automating the purchase and sale of green energy.

Health Sector: Patients have access to their medical records from anywhere in the world. The entire medical record can be viewed and alerted to the paramedic, who can assist in identifying the issue and prescribe medication without the risk of any allergic reactions, by providing the key access like patient fingerprints.

Block chain’s Value in the Supply Chain

Hyper ledger, not Bit coin, is used to build the related block chain platforms of Oracle, SAP, and IBM. The advantages of block chain allow us to avoid spending money, time, and many attempts. Any type of hacking attempt or cyber-attack cannot penetrate the block chain. Businesses might get a variety of advantages from block chain technology. Some of them consist of: Gaining credibility and sharing data will increase public confidence. Including the parties involved, absence of malpractice, lowering the risk to public relations. Retailers, manufacturers, and service providers can better understand consumer feedback and anticipate their needs with the aid of block chain, which will help them increase customer satisfaction and grow their

businesses. By fostering candour and trust between businesses and the final consumer, block chain technology has the potential to be much more profitable in the future by enhancing the supply chain's traceability, security, and transparency.

Legal Factors to Consider When Using Block chain: Any organisation using block chain for supply chain management or logistics should think about any potential legal ramifications. Laws that businesses should abide by include: Enforcement of judgments against foreign parties, Ethereum-based contracts, Conflict-resolution procedures, laws protecting your privacy, requirements for transportation regulations, Threats to cyber security, Barriers to the Use of Block chain, Budget, Poor Standards, Insufficient industry support, Regulational Concerns, not realizing the worth, lack of knowledge.

The efficiency, effectiveness, and validity of many crucial criteria in the food and agricultural supply chain are receiving increasing attention as a result of globalized industrial and agricultural production. There is a great demand for effective traceability solutions that serve as crucial quality management tools to guarantee adequate product safety across the agricultural supply chain due to the rising incidence of food safety and corruption risks. Block chain is a cutting-edge technical approach that achieves ground-breaking results for commodity traceability in food and agricultural supply chains. Today's agricultural supply chains are complex ecosystems with many different stakeholders, making it challenging to validate a number of important requirements, particularly with regard to the country of first origin, crop growth stages, compliance with quality standards, and yield monitoring. In order to monitor crop prices and ensure traceability, this study suggests a method that levitates the block chain and successfully manages commercial activities along the agricultural supply chain. The suggested framework solution does away with the need for middlemen, centralized authorities that can be trusted, and provides records of the transactions, enhancing effective science and safety with a high degree of integrity and dependability. All transactions are recorded, then kept in the immutable ledger of the block chain with connections to a decentralized le network, enabling a high degree of traceability and transparency in the supply chain ecosystem in a steady, dependable, and effective way.

Patrick Ndayizigamiye and Nurudeen Ajayi[1]Due to supply chain inefficiencies, South African healthcare facilities frequently experience a shortage of supplies. Causes of these inefficiencies include inadequate middlemen, a lack of transparency in the supply chain processes, and problems with trust. One strategy for controlling the difficulties the healthcare supply chain is to minimize the impact of intermediaries, claim. Additionally, improving the visibility and openness of supply chain transactions may aid in managing the difficulties that the healthcare industry's supply chain faces. Block chain is increasingly being thought of as a technology solution that can solve some of the issues with global supply chain management. This is so that confidence can be established inside the network of the supply chain and transactions in the supply chain may be made transparent. Additionally, it can assist in minimizing the impact that middlemen or intermediaries have on the supply chain network. This research aims to illustrate how block chain technology might assist alleviate some of the inefficiencies within the South African healthcare supply chain using the Systems Thinking Approach. First, causal loop

diagrams are used in the study to show how various stakeholders interact within the South African healthcare supply chain system. The study then discusses how block chain can improve trust connections between different stakeholders, or between loop diagram nodes. The research also shows how block chain may be helpful in removing middlemen from the South African healthcare supply system, hence lowering the cost of healthcare delivery. This paper is expected to clarify the role that emerging technologies can play in solving complex issues in the context of developing nations.

Wolfgang Kersten and Mayolo Alberto Lopez Castellanos [2] studied describes the incorporation of geographic data into the Supply Chain Building Blocks (SCBB) agent-based simulation model to improve performance analysis of supply chain designs. Geographical data enhances the modelling precision of the static and dynamic aspects of the supply chain for the geographical and temporal characterization. The geographically positioned supply chain participants (modelled as generic agents) and the routes describing their interconnections are static elements in the SCBB. Transporters are dynamic supply chain components that mimic multi-modal material flows. The lead times resulting from the properties of the method of transportation and the descriptions of the routes are used to transfer material in instances of transportation agents. Participants in the supply chain in SCBB evaluate their behavioral policies for simulating business functions and for interacting with other agents using geographic information. By supporting the comprehensive performance analysis of supply chain designs for strategic decision-making (such as capacity allocation and location decisions), business function configuration (such as management strategies for sourcing, inventory, production, and distribution), and phenomenon understanding, the use of geographic information improves the SCBB modelling capabilities.

Abbas Batwa and Andreas Norrman [3]The aim of the study is to identify, investigate, and present various supply chain management applications of block chain technology, along with a framework for their analysis. The study clarifies which minor applications are hyped and which are currently more practical, addressing researchers' divergent views on the hype of block chain. This aids supply chain professionals in evaluating the various block chain applications before it is too late to change a decision regarding their use. The framework was created using a systematic examination of the literature on articles relating to block chain, and it was then tested using semi-structured interviews with four businesses that used the technology. Traceability and supply chain financing seemed to be the most practical block chain uses in supply chain management, according to research findings. However, additional uses were also discussed, including standard compliance, supply chain integration, and transaction digitization. The lack of applicable situations for this research, given that block chain is still a relatively new technology, limited its scope. As a result, this study cannot be regarded as a case study; rather, it is a literature analysis with a small number of interviews. The study did, however, produce a conceptual framework that will serve as the foundation for additional exploratory studies using more empirical data.

This research study's goal is to look for potential research projects that could use block chain technology to improve supply chain and logistics. The associated difficulties with applying block

chain to supply chain management are also discussed, along with potential solutions. Both theoretical and empirical methodologies are used in this research to achieve the study's purpose. Regarding the theoretical approach, relevant block chain literature was examined while taking into account both technical and economic factors, its architecture, and implementation difficulties. Three case companies involved in wood construction, consulting and regional development, and technology were examined for the empirical portion of the study. The use of block chain in the supply chain activities of three example firms has been examined. According to the study's findings, block chain technology may be effectively used to supply chain management in a variety of commercial sectors to provide, for example, greater services and transparency [4]. The management and control of supply networks are increasingly challenging as a result of globalization. Block chain technology is demonstrating promise for solving some issues with global supply chain management as it is a distributed digital ledger technology that ensures transparency, traceability, and security. In this essay, the use of smart contracts and block chain technology in supply chain management is critically analyzed. We are now looking at how block chain might address and help supply chain sustainability in light of demand from local and international governments, communities, and consumers to fulfil sustainability targets. This critical analysis includes a look at how block chains, a young, potentially revolutionary technology, may get past several obstacles. We present the categories of inter-organizational, intra-organizational, technical, and external hurdles to the use of block chain technology. We suggest future study proposals and approaches that might provide insights into overcoming obstacles and using block chain technology for supply chain management. True block chain-led business and supply chain transformation is still under process and in its early phases.

Ralf Christian Härting *et al.* [5]Meanwhile, nearly every aspect of society and business is being impacted by the rapidly evolving digitization. The widespread usage of digital information technology is a key foundation for this progress. The distributed ledger technology has been recognized as having particular business-related potential. The goal of this study is to look into factors that could affect how block chain technology, which is a type of distributed ledger technology, might be used in supply chain management. The data base is an empirical, qualitative data collection obtained through expert interviews. By analyzing the interviews using grounded theory methodology, the conceptual model is created. The conceptual model is formed by significant influencing elements (trust, efficiency, costs, control, privacy, and scalability) and moderating effects (use case, knowledge, cooperation, and regulations) for the potential of blockchain technology in supply chain management.

Assunta Di Vaio and Luisa Varriale [6]This study examines the key effects of block chain technology on operations management (OM), with a focus on the supply chain management (SCM) decision-making procedures from the standpoint of sustainable performance. Analyzed are the connections between OM, block chain technology, and sustainability concerns in SCM. A thorough review of the key contributions to the literature that have concentrated on block chain technology and OM in SCM is included in this two-step research study. By analyzing and processing financial statements, non-financial reports, and the website of one important airport infrastructure in southern Italy, it examines the airport industry from the perspectives of sustainable performance and data analysis. The Airport Collaborative Decision Making (A-

CDM) platform was successfully implemented in the Italian airport infrastructure under investigation. One of the main uses of block chain technology in the airport sector is this. In order to lessen operational fragmentation, inefficiency, and uncoordinated behavior, it encourages collaboration between the major aviation sector actors and the air traffic controllers (ATCs). It also permits the interchange of data and information, although a high degree of sustainable performance may still not be shown. Although using block chain technology has many advantages, particularly in terms of enhancing OM, these new technical advancements do not ensure the optimum performance in terms of efficacy, efficiency, and sustainability concerns. To establish a genuine forum inside their collaborative network with a shared culture and mutual trust, managers and policymakers must collaborate.

The previous study on block chain technology with worries about OM and sustainability problems in the Italian airport context is enhanced by this article's insightful interpretation of the technology.

Abderahman Rejeb *et al.* [7]Supply chains in the modern era have developed into incredibly complex value networks that are now a key source of competitive advantage. Verifying the origin of raw materials, however, and maintaining product and merchandise visibility as they move through the value chain network have grown more and more difficult. The Internet of Things (IoT) application may assist businesses in observing, tracking, and monitoring goods, actions, and processes inside their own value chain networks. Product monitoring is another IoT use that helps warehouse, manufacturing, and transportation activities run more efficiently. Block chain technology can enable a wide range of various application scenarios when combined with IoT to improve value chain transparency and boost B2B trust. Modern supply chains might become more productive and efficient when IoT and block chain technologies are merged. This study makes two contributions.

First, we show how the use of Block chain technology in conjunction with IoT infrastructure may improve value chain networks and modernize supply chains. In order to build the groundwork for future research initiatives, we also extract six research hypotheses that describe how Blockchain technology might affect important IoT properties such as scalability, security, immutability and auditing, information flows, traceability and interoperability, and quality.

Rekha Goyat *et al.* [8]The supply chain is becoming a promising topic of interest among emerging jobs in numerous sectors as a result of the quick advancements in technology. These professionals manage logistics on a daily basis as well as information systems, transportation, and product development. However, as simple and pleasant living conditions have quickly evolved, so has the need for product visibility and end-to-end traceability. Comparing the current supply chain to innovative and cutting-edge technology reveals how inefficient, immobile, unmanageable, and expensive it is. Block chain is a cutting-edge technology that has a tremendous influence on supply chain networks.

DISCUSSION

The use of blockchain outside of banking has primarily been exploratory. Supply chain, energy, and food/agriculture applications of blockchain are anticipated to be among its most promising non-financial uses. These industries might be considered good candidates for block chain. At a young stage of blockchain development, these industrial use cases are thought to produce real ROI. Supply chain, among the numerous activities that are expected to be revolutionized by block chain, merits particular attention. The use of Internet-of-things (IoT) applications will be used more frequently, which is one of the trends that will impact supply chain management (SCM). IoT, RFID tags, sensors, barcodes, GPS tags, and chips allow for the tracking of items, shipments, and shipping containers at every stage of their journey. This enables better real-time tracking of commodities starting at their point of origin.

In this context, there is a strong need for a secure way for identity confirmation in IoT applications. The first direct benefit of blockchain is that it may offer a solution for identity management. To track who is doing what tasks in a supply chain, utilize block chain technology. The acts' date, time, and place may also be identified. Measurements of the results and effectiveness of crucial SCM processes are made possible by block chain. The input tracking data becomes immutable once it is stored on a blockchain ledger. Shipments, delivery, and progress may all be tracked by additional chain vendors. Blockchain fosters supplier confidence in this manner. Efficiency may be improved and expenses can be decreased by getting rid of intermediary auditors. On a nearly real-time basis, individual suppliers can conduct their own checks and balances.

Blockchain also offers a precise method of gauging product quality while it is being transported. For instance, stakeholders in a supply chain might determine if a product was at the incorrect location or stayed there for an excessive amount of time by examining data on the journey route and duration. This is crucial for chilled items since they can't be kept in heated conditions. For nations like China, where meat smuggling has resulted in serious health risks and a sizable loss in tax revenue, this value proposition is even more pertinent. Blockchain-based solutions may instil more customer trust in the authenticity and quality of the items, increasing their propensity to buy the brand. Due to bad press, restaurant closures, and inquiries, the company's image took a hit. Sales fell sharply, and the share price fell by 42%. Part of the issue stems from Chipotle and other food businesses' reliance on numerous suppliers to deliver components and ingredients. Across intricate supply chains, there is a serious lack of accountability and transparency. Food businesses like Chipotle are unable to keep an eye on their suppliers in real time. Chipotle will therefore be unable to stop the contamination or contain it after it has been found.

There are several ways available to guarantee cost reduction. The supply chain eliminates manual paper-based procedures, human document carriers, and air courier costs. The Maersk case demonstrates that shipping container documentation can be fully digitalized and tracked. The Ever ledger example demonstrates that supply-chain certification procedures may be more easily automated thanks to block chain technology. The Modum example demonstrates how block chain enables the precise allocation of resources for shipping and other activities. Block chain also incorporates entity identification at the unit level (rather than the batch level).

Businesses can take advantage of the digital network's zero or very low marginal cost economics. The supply chain is likely to change as a result of this combination. Therefore, even for small transactions, generating a block chain code makes financial sense. Even supply chain operations involving a tiny volume of goods, such putting few dozen quarts of apples or blueberries into a juicer or transferring a combination of liquid and solids into a sieve to remove the particles, may be recorded affordably.

Block chain can cost-effectively confirm everything related to the supply chain history of food products by combining it with data related to temperature, humidity, motion, chemical composition, or other relevant indicators that can be collected from IoT devices or sensors on equipment. If technologies like IoT have already been used to detect, measure, and track important SCM processes, then the marginal costs associated with block chain are therefore zero or low. Walmart is one company that has advanced IoT deployment. It submitted a patent application in October 2016 that outlines the addition of Internet of Things tags to products made using Bluetooth, RFID, infrared, NFC, and other technologies. The tags will automatically place refill orders while keeping track of product usage patterns. The IoT tags can also keep track of product recalls and expiration dates. The concept of cost savings needs to be qualified. It may take a while for it to come to fruition, just as many other technological initiatives do. For instance, Maersk predicted that costs would likely drop dramatically, but that it would take about two years for the blockchain technology to start showing savings. Blockchain could automate many processes and make them run more effectively once the rules are in place. Block chain offers a number of quality assurance and assessment mechanisms. There are significant scams involving counterfeit goods, including prescription medications, exquisite wines, and designer clothing. According to one estimate, the annual value of fake fine wine is around $1 billion. Ever ledger claims that fake bottles make about one-fifth of all sales of worldwide "fine wine". Thus, it is critical in a variety of industries to manage the risks associated with counterfeiting. Block chain adoption in the supply chain is more likely to occur in sectors that are vulnerable to counterfeiting.

Additionally, block chain may support quality assurance for items by providing pertinent data. The Modum example demonstrates how the quality of a product may be ensured by supplying data relating to indicators such as temperature, humidity, motion, light conditions, chemical composition, from IoT devices or sensors on equipment. Block chain increases supply chain reliability by putting pressure on participants to operate with more responsibility and accountability. The Gem alto case shows that personal accountability and responsibility may be mandated and justified. Be aware that in a traditional or "centralized" ledger, the "trusted third party" is just one authority. Each user has a validated copy of the distributed ledger in a block chain system. The ledger's transactions are instantly visible to the user. As mentioned above, some businesses evaluate the way environmental and social concerns are handled by asking suppliers for their self-reported responses. The lack of mechanisms to validate a supplier's claims is an issue with this approach. This issue can be solved by the "super audit trail" of blockchain technology. In the event of a disagreement, blockchain also offers the flexibility of allowing users to review the details of each relevant party's record in the past. Block chain can increase the speed at which various operations are carried out. For instance, by digitizing physical processes

and minimizing interactions and communications, a faster rate can be attained. As one might anticipate, the initial attempts to apply block chain to supply chain were focused on addressing the multiple sources of risk. The technology to cope with atomistic sources of risk is, however, expected to become more widely used as more affordable alternatives are being investigated.It's important to note how alternative risk-reduction strategies might be used.

Complex supply chain issues may be resolved with the use of blockchain technology. The use of blockchain will boost productivity, improve supply chain visibility, and eventually stop errors and fraud. Blockchain enables businesses to conduct transactions directly and without the involvement of a third party, increasing the efficiency of global supply chains. Additionally, it makes it easier for financial and logistical services to be more integrated, enhancing stakeholder data collaboration.

Supply Chain Can Be Enhanced by Blockchain: Blockchain technology may be used in a supply chain to monitor and record information about product shipments.With blockchain, all pertinent data can be recorded, increasing the transparency of the supply chain process and the use of supply chain mapping.With the use of this technology, businesses can prevent and lessen fraud.Both the domestic and foreign supply chains might benefit from them by increasing the product safety. The information given by blockchain may be used by all participants in the supply chain, from producers to merchants, to make knowledgeable choices. For instance, they may utilise current data to guarantee that goods adhere to manufacturing standards. By doing so, mistakes will be decreased and quality control will improve. Businesses may save expenses and boost efficiency by using it. Additionally, they may increase consumer faith in their brand. Customers are more inclined to repurchase goods when they are confident in their safety.

Application of Blockchain Technology in Supply Chain: As an example, let's look at companies in the food sector. These companies, like restaurants, handle fresh food, making it essential for them to track the product from its source to the final consumer since it is very perishable. With the blockchain, it is simpler to trace pig obtained from China, for example, since it is more transparent and allows for the tracking of every piece of meat, its processing, its delivery, and its sale. As a result, the whole process is improved, resulting in a higher degree of quality for the final customer.

Advantages: Increased cooperation amongst supply chain participants; transparency at every level;Enhanced encryption and security; data decentralization and the potential for consensus;

Disadvantages: Scaling a block chain could be difficult, a lack of restrictions over data access; a potential for partial compliance with certain nations' legal requirements;

Blockchain Transform Supply Chain Management: It is quite simple to convert a standard supply chain into a global supply chain with the aid of blockchain technology. This is because money can be transmitted easily, securely, and from anywhere, eliminating the need for a bank to process payments. Blockchain technology will improve supply chains' transparency and efficiency, resulting in time, effort, and resource savings.

CONCLUSION

Quality, cost, and speed challenges must be overcome by supply chains. Blockchain technology makes it simple to meet these requirements for supply chain management. The benefits of blockchain include the avoidance of fraud, misunderstandings, and pointless agreements. With the aid of blockchain, the entire supply chain ecosystem advances and becomes more transparent to businesses and customers.

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CHAPTER 14

LOGISTICS IN FOOD SUPPLY CHAINS IN A CIRCULAR ECONOMY

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Abstract:

It is a strategy of regeneration in agriculture or the circular economy for food that seeks to reduce waste by maximizing the use of resources available. It seeks to maintain a closed-loop supply chain that increases product life and minimizes waste.In food supply chains, CE gets along with people and the environment, This chapter covers the problems of the transition to the CE economy, plant-based protein alternatives, and the benefits of the CE.

Keywords:

Circular Economy, Food, Logistics, Supply Chains.

INTRODUCTION

Even though there is enough food produced today to sustain everyone on the planet, two billion people are overweight or obese, leaving around 800 million people undernourished. The cost of this harm to the environment and to human health is far higher than the profits generated by the agricultural sector. Food waste also involves the materials, cash, and labour needed to produce it. The Waste and Resources Action Program (WRAP) estimates that each year, UK homes produce 8.3 million metric tonnes of food and beverage waste, valued at a minimum of $18.6 billion and accounting for around 3% of all domestic greenhouse gas emissions. Similar to this, US homes squander over 150,000 tonnes of food daily, amounting to more than 10 kg of food wasted per person every month. One in seven Americans, or 46 million people, utilise food banks, therefore 20% of the food purchased by the typical American is never consumed[1], [2].

If food waste were a nation, it would be third in the world in terms of CO2 emissions, after China and the US. With rising CO2 emissions, eutrophication, and food waste, current methods of food production and consumption have had a detrimental effect on the environment. Food waste has major repercussions for the agricultural industry, particularly for smallholder farmers and their livelihoods (of whom 500 million are responsible for producing 80% of the food eaten in developing countries). Since approximately 80% of the world's poor reside in rural regions and mostly labour in agriculture, this regrettably impacts the world's poorest and most malnourished people. One in three women are anaemic, and food insecurity is shown by an increase in obesity. Half of the world's population is undernourished, and hunger rates are still rising. The food industry is presently responsible for 70% of freshwater extraction and 30% of greenhouse gas emissions. The depth of the inefficiency and ineffectiveness in our current food systems is shown by these figures. Food insecurity is not the only issue with hunger; there are also logistical, governmental, and human issues. The answer is a circular economy.

There is increasing agreement that moving from our existing industrial "linear" paradigm to a circular economy (CE), which provides instruments to decrease waste created in the food chain, is the only option to assure sustainable production and growth. To create an effective and sustainable food supply chain, this involves recycling nutrients and using food waste and byproducts. As of right now, our model is linear, as in take, manufacture, utilise, and discard. Natural resources from the environment, "create" something, "use" it or not, and then "dispose" of it. For instance, at a grocery store, food that is still edible but has to be taken off the shelves—often owing to inventory or overstock issues—usually ends up in the trash. To prevent this wasteful scenario that threatens economies throughout the world, we need to take a fresh approach. Zero food waste in the food chain is the goal of a circular strategy, which includes reuse, recycling, remake, and redistribution. For example, misshaped or mildly discolored fruits and vegetables that don't match the demanding aesthetic standards of supermarkets account for a significant portion of the food waste issue yet may be crucial to circular economies. Retailers often only accept between 60 and 80 percent of a farmer's food owing to aesthetic concerns, thus a system that incorporates helpful organizations is required to make use of these items.

Overcoming challenges: The potential cost of food waste throughout the supply chain, which may be included into an effective CE cycle, is often unknown. In this case, the value of the best abandoned option is the opportunity cost. For instance, farmers are unaware of the opportunity cost associated with food waste that is disposed of in landfills as opposed to being converted into energy, compost, or animal feed. Information on how to reuse, recycle, or cost-effectively utilise food waste would be helpful to farmers. To make the most use of the resources, farmers also need to identify and collaborate with other players in the supply chain. It is essential to ascertain how stakeholders might cooperate and explore viable uses for waste materials in order to form synergistic partnerships where waste and byproducts can be traded, sold, or moved. The demand-side elements of sustainable consumption and end-consumer behaviours, such as food choices, physical flows, and waste creation at the home level, have been conducted as an alternate method of tackling the issue.

By mapping possible by-product synergies between farming, processing, and retailing as well as food waste scenarios, it is necessary to address sustainability challenges from the supply-side of the food chain. Additionally, we must create creative economic models that might provide incentives for participants in the food supply chain to use circular thinking. It is a waste of a precious resource to dump food trash. Food waste may be used to feed animals, improve the soil as a fertilizer, and create renewable energy with the right equipment and approach. A shift in perspective: Food waste reduction is economically feasible and may open up new business prospects. We must alter our strategy and begin looking for other ways to cut down on food waste. Recognizing that food loss represents a missed business opportunity, we must actively look into potential sources of food waste. To better accommodate the reintegration of food that would otherwise be discarded into the manufacturing cycle, we must assist in redesigning the supply chain. All food wholesalers, retailers, and most importantly, customers, are accountable for it.

The following are potential loops in the food supply chain: Food waste has the potential to be utilized as a renewable energy source, offering food companies a great supply of energy for their manufacturing process. Food waste may be converted into bio-fertilizer, which would replenish soil nutrients and serve as biofuel. According to estimates, up to 90% of garbage may be recycled. These projects might help several sectors become more profitable and sustainable.

Food surpluses might be donated to organizations that support vulnerable and disadvantaged areas, such as charities and food donation partners. Discounts on food that has reached the end of its shelf life may be offered to employees. This might be used to encourage the workers at work and provide them with extra incentives. Food waste has the potential to be an excellent source of feed for cattle.

There have been major advancements in both the technological and commercial realms that might be used to move the food supply chain in a circular direction. The following are some instances of significant advancements: In-vessel waste treatment via anaerobic digestion is a cutting-edge technique that has emerged recently. This technique turns greenhouse gases like methane into electricity and offers a large-scale solution for biological waste. Recent developments in waste-to-energy technology, including gasification, pyrolysis, and plasma arc gasification, are being exploited by major players in the market. In addition to technology developments, sustainable business management has introduced significant business management approaches. For instance, to effectively control waste, closed-loop supply chains and reverse logistics incorporate elements such as product design, performance assessment, and value recovery strategies. By incorporating waste reduction into design, this encourages participants in the food supply chain to help create a more sustainable economy and increase consumer happiness. Similar to this, the food industry's supply chain integration and cooperation amongst chain members is a growingly popular way to manage circular processes via information exchange and cooperative strategy formulation. Additionally, via data-driven logistical planning, the Internet of Things and Big Data are playing a crucial part in a circular economy.Finally, in order to make choices for developing a circular economy, a thorough knowledge of the data and waste streams is essential. There is hence a need for more research, precise measurement indicators, and ultimately an accessible practical toolkit for use by participants in the food supply chain. The development of this field will need a considerable contribution from universities and research centers. Universities might provide their students these services. In addition, training and evaluation for many players in circular economies can be essential instruments.

Multiple parties with intricate interrelationships make up supply networks. In order to close the loop on supply chains, many stakeholders exchange materials, information, human resources, and funds both forward and backward. Due to both economic and environmental concerns, reverse logistics (RL) operations are becoming more and more significant in terms of both scale and quantity. These supply chain RL flows are dynamic and complicated in design. Furthermore, there is a dearth of comprehensive research on the effects of RL activities on the environment. To examine and understand the green performance of RL operations by foreseeing their environmental effect, a system dynamics model has been created in this work. A case study that took place within the framework of a food supply chain used to validate the suggested model. The environmental impacts of RL operations have been examined inside the organisation where the case study is being conducted. A system dynamics model has forecasted these activities in the food supply chain in terms of CO_2, NO_x, SO_2, and PM emissions for the years 2020 to 2024. The suggested technique is used in the context of food supply, a significant participant in retail, particularly in developing nations. Our research indicates that by reducing food loss and waste, RL activities in the food supply chain may considerably contribute to green performance management; as a result, the environmental effects of such activities should be carefully studied from a managerial standpoint.

Zúñiga F[3]A practical analysis of the circular economy is made possible by the study of the logistics of the food supply chain, which is based in principle but not exclusively on that of fresh products. It also contains some intriguing recommendations for putting the recently passed EU legislation into practice and creating new regulations. The so-called "final mile," in particular, has not gotten the attention it deserves in this area when it comes to logistics.

The food industry's post-harvest supply chain, as well as creative and ecologically friendly technology solutions, are discussed in this research in terms of ecological packaging, active packaging, and/or intelligent packaging. These issues are all presently in the spotlight as a result of the significant growth in product purchases and sales on online marketplaces, as well as the need for more stringent food security and safety. With a focus on cybersecurity, product information, communication, and shelf-life extension, this study aims to raise the global awareness of agro-industrial micro, small, and medium size enterprises for the adoption of innovative food solutions through industry digitalization (Industry 4.0), associated logistics, and circular economy. The adoption of these guidelines will undoubtedly promote awareness of environmentally sustainable technological solutions for the post-harvest food supply chain along the entire food chain (from producer to consumer, with all intermediary parties), thereby promoting the future food sustainability required by population growth, climate change, the exodus of rural residents to urban areas, and food loss and waste.

Zacharoula Andreopoulou [4]The huge network of gadgets interacting automatically via the Internet is known as the "Internet of Things" (IoT). However, the circular economy dominates current efforts in sustainability research. Out of the 17 newly formed Sustainable Development Goals, the food problem is prevalent in 10 of them. It will be possible to solve issues with the circular economy in the food aspect, such as reducing food waste, improving food traceability, improving food quality, acquiring food authentication, optimizing supply chain and logistics, etc., thanks to shorter distribution lines and supply chain optimization.The need to include sustainability into company operations is becoming more important. Along with a well-established emphasis on forward logistics, reverse logistics is becoming more and more popular. Reverse logistics supports sustainable practices and boosts businesses' competitiveness, but it also has drawbacks. As a result, there are risks involved in putting reverse logistics into practice. By examining the evolution and extensive potential of reverse logistics as a sustainability tool, this research tries to close this gap. Design/methodology/approach: Real-time Delphi research was carried out to fill the research gap. 14 forecasts for the German food industry in 2040 were developed by comprehensive desk research, semi-structured interviews, and an expert workshop. The future estimates were evaluated by 49 experts in the fields of logistics, reverse logistics, and food logistics with regard to anticipated likelihood, effect, and desirability of occurrence. Findings: The research's conclusions point to three distinct future possibilities as well as potential motivators and hindrances that the food industry, the government, and society as a whole should take into account in order to successfully adopt reverse logistics in the food supply chain. Originality/value: The research investigated the potential use of reverse logistics in food supply chains as a strategy for sustainability. The findings provide a framework for making choices on the sustainable orientation of company activities, increasing competitiveness and fostering resilient business strategy. For practitioners, politicians, and society as a whole, many conclusions are drawn that support reverse logistics. By performing a quantitative dissent and sentiment analysis while taking into account numerous surface-level and deep-level diversity factors, this research advances the previous Delphi methodologies methodologically.

It has become clear that one of the most important criteria for determining a product's quality and safety is its traceability, or the ability to obtain information about it and its movement along the whole supply chain. Being perishable with limited shelf life and susceptible to environmental factors, managing fresh items like fruits and vegetables is a particularly challenging undertaking. Because of this, fresh product traceability is highly important. A short summary of the relevant literature on fresh produce traceability systems is included in the current research. It was determined that the commercially available traceability solutions often do not depend on open and transparent interoperability standards or cover the whole length of the supply chain. In order to establish an integrated solution for traceability and agro logistics of fresh goods, emphasizing on interoperability and data exchange, a user-friendly open access traceability system is presented. An android-based platform allows for the monitoring of the quality of fruits and vegetables along the whole agri-food supply chain, beginning from the field level to the consumer and back to the field. Various Internet of Things technologies are integrated and linked to the web. The technique, known as Agro TRACE, is also applicable to waste management, which is a crucial component of a circular economy[5]–[7].

Given that the global food sector has a very substantial environmental and social impact, managing sustainability in the food supply chain is essential. Due to demand from stakeholders, actors in the food business have also become more interested in these concerns. This emphasizes the significance of identifying what sustainability strategies and best practices are being used. This assessment outlines the present level of knowledge about the implementation of sustainability in operations and supply chains by food manufacturing enterprises. 130 publications that were published between 1999 and 2020 spanning a 21-year period were subjected to a thematic analysis to find eight major sustainability topics. Life cycle assessments, drivers, barriers, and incentives for sustainability, waste and recycling management, logistics in the food chain, sustainability practices in small and medium-sized enterprises (SMEs), supplier management, partnerships, and relationships, and "other" sustainable supply chain management practices were some of the themes covered. By reviewing the existing literature, it is evident that there is still much need for investigation into the roles of SMEs and food logistics, despite the importance of both in sustainable supply chain management. It is also obvious that major multinational corporations play a crucial part in supporting supply chain practices by not only promoting best practices but also by providing vital resources and fostering cooperation among supply chain partners. Although it is argued that future research should concentrate on digitization efforts such as through Internet of Things and block chain that have been highlighted as a major disruptive and supportive element in increasing sustainability across supply chains, circular economy is emerging as a key research area that is experiencing increasing focus in recent years.

DISCUSSION

Food supply chains, sometimes referred to as "farm to fork" systems, include all processes that turn foodstuffs (i.e., raw materials) into consumer-ready food products, including sourcing, processing, handling, distribution, and sale, as well as the administration and documentation of these processes.

In order to manage food supply chains, it is necessary to record a variety of parameters at each link in the chain, including the entering material quality, processing techniques, storage conditions, and departing quality. In order to enable lot traceability, collaborative coordination

and optimization of operations, product consistency and quality management, regulatory compliance, and ultimately customer safety and satisfaction, it is essential to synchronize and share this information among all of the parties involved along the chain.

In order to supply customers with high-quality, safe food without endangering human life or the environment, RL is required in the food sector. The issues faced by RL in the food business include food returns, food recalls, recycling, reuse, and disposal. The use of RL in the food business is necessary for a number of reasons. These include shorter product lifecycles due to probable product damage and expiration, the return of subpar items, and noncompliance with good manufacturing standards. Customers return low-quality items because of their short shelf lives, particularly meat and dairy products since they are prone to rotting. Reducing food, packaging, and material waste are three significant areas in the food business where RL is crucial. The fact that food is a perishable item, meaning that there is always a chance of returns to the maker, is the largest difficulty for RL procedures in the food business. Food loss and waste are becoming major problems that the public finds concerning. Additionally, according to the 2030 Agenda for Sustainable Development, by 2030, the worldwide rate of retail and consumer food waste is to be cut in half per capita. Due to a greater worldwide awareness of the issue of food waste, there is also a push to decrease food losses and waste in food supply chains [7]–[9].

According to the FAO, improper handling of food waste resulted in 3.3 billion tonnes of carbon dioxide emissions in 2013. In light of this, there is a connection between food waste and CO2 emissions. Food waste has been demonstrated to be the source of 10% of GHG emissions. Food producers and distributors have been motivated to alter RL practices as a result of the increased concern over food waste. By implementing systems for reuse or recycling possibilities, controlled effectively via reverse supply chain networks, food waste may be decreased. Waste from packaging and transportation materials, such as pallets and crates, are additional significant challenges in the food sector that need to be addressed. However, because of the return and remanufacturing procedures, RL operations have several drawbacks. When things are reprocessed in remanufacturing processes, some actions might produce contaminants and gas emissions.By 2050, the population of the globe is projected to increase quickly to 9.8 billion. In order to meet the increased food demand, food production must feed an extra two billion people during the next 30 years.It is difficult to meet future food demand with the limited resources that already exist, and this will eventually put more strain on the ecosystem. Even now, the effects of the food system have led to an 80% loss in biodiversity and a 1/3 increase in greenhouse gas emissions. Another significant problem with the food chain is food loss and waste, which accounts for one-third of all production of edible foods, or 1.3 billion tonnes annually. On the other hand, hunger affects around 10.7% of the world's population. The present food supply chain (FSC) is thus confronted with the modern trilemma of food security and shortage, environmental deterioration, and food loss and waste that calls for urgent sustainable solutions.

The idea of the Circular Economy (CE) as a viable solution to all the uncertainties and challenges that lie ahead has experts in the food system excited. A system that is regenerative and restorative by design is what CE, a sustainable paradigm, aspires to create. The ideas of reducing, repairing, reusing, refurbishing, remanufacturing, and recycling are used in the CE to replace the 'take-make-trash' paradigm of the linear economy, resulting in little to no waste creation. Reduced food waste from different levels of the food chain, the use of by-products and food waste, the recycling of nutrients, the reuse of packaging, and dietary changes that have a reduced environmental effect are all examples of CE in the FSC. A further estimate puts the

yearly economic value of CE adoption at 1.8 trillion EUR by 2030. As a consequence, moving toward CE will save money while simultaneously addressing social issues like environmental preservation. However, the transition to CE faces considerable difficulties since the current strategy is based on a linear economy that prioritizes resources. Businesses are unable to transition to circularity because of these barriers. As a result, that the main force behind CE use in supply chains would be identifying and eliminating adoption hurdles. Through this research, we want to get closer to the goal of identifying difficult barriers to the CE transition, especially in FSC, as a firm basis for resolving the current food system trilemma.

The prior academic literature includes multiple barrier studies of CE adoption for different supply chains and supply chain methods since academics have acknowledged the significance of this topic. From a broad supply chain perspective, identifying hurdles in FSC in the Chinese setting since FSC has its own specific vulnerabilities because the authors recognized the value of detailing specific supply chains. Then looked at the setting of India, where FSCs are more irregular and complex. Stated that the literature lacks a complete list of problematic criteria identified for FSC uniformly, notwithstanding current excitement for adjustments to CE adoption in FSC. Since there is a significant scholarly void, we built our research to help apply circularity in sustainable food chains.

A network connecting customers, farmers, and producers is known as a food supply chain. In order to provide consumers with safe and secure food, a number of stakeholder's farmers, producers, distributors, warehouses, retailers, etc. have worked together in the FSC network. The conversion of farmers' raw food into processed food and distribution to customers is associated with a number of wastes. Global food waste in 2019 was estimated by UNEP to be at 931 million tonnes, with homes, food service, and retail accounting for 61%, 26%, and 13% of all edible food waste, respectively. From a social, ecological, and economic viewpoint, food waste has negative effects. After following the 3Rs, good waste management in the FSC is required to dispose of the least amount of garbage in landfills (reuse, recovery, recycle). As a result, the FSC's close-loop supply chain contributes to less waste. A circular concept increases the utilization of generated food and lowers global food waste as a consequence.

Waste management is essential since food waste is linked to significant greenhouse gas emissions, negative environmental effects, biodiversity loss, and other issues. The biggest obstacle to sustainable development is the management of food waste, which results from the inefficient handling of food excess. A hierarchy of food waste management, including avoidance of food loss and wastage, reuse, recycling, recovery, and disposal, is provided. However, there remains a large gap in the FSC for managing food waste. Food loss and waste reduction, is a crucial component of the circular economy (CE) and aids in the achievement of sustainable development objectives (SDGs). So, in order to reduce waste, recycling, and recovery, FSC must implement CE. As a result of these issues, there aren't many practical applications of CE in FSC. One such idea used in the FSC to decrease food waste is the CE principle. In terms of FSC, CE has quickly evolved into a strong driving factor supporting SC sustainability in both research and practice. SC management (SCM) offers CE as a brand-new, cutting-edge sustainability barrier. The trash generated in a linear supply chain is promptly sent to landfills, but CE has a zero-waste target with little landfill waste, and certain major SC leaders are implementing the CE characteristics, including Apple, Coca-Cola, and Colgate-Palmolive. Firms must comprehend and address significant hurdles in order to effectively embrace CE practice in FSC. Using CE in FSC provides a number of benefits. It may maximize food value, cut down on waste, and need

no more acreage. In order to achieve sustainable development goals including sustainable consumption and production (SCP) and ending hunger, CE adoption in FSC is critically needed.

The circular economy's advantages for society: For a very long time, the linear economic model served our economies well, bringing us the present levels of wealth. If we want to live sustainably, now is the moment for the world to make crucial choices about the economies and global industrial systems. We are the dominant species on Earth for a reason, and if there is one thing we are good at it is overcoming challenges. But this time, the chance to transition to a circular economy offers more societal advantages.

1. Good health and ecological harmony: The health and environmental advantages of the circular economy must be included while discussing its social advantages. Regenerative food production, which emphasizes generating high-quality food and enhancing the surrounding natural environment, is given a lot of emphasis in a circular agricultural system. Because of this, regenerative farmers utilize organic fertilizers and methods to increase soil fertility, such as rotational grazing or crop rotation.

2. Food safety: The concepts of circularity may boost customers' access to fresh food and, as a result, food security. With the existing system, food goods must travel across the globe before they can be consumed by a customer. This food system is obviously bad for the environment and vulnerable to calamities like the Covid-19 epidemic. The circular economy puts a premium on eating locally produced and consumed food to prevent these hassles.

3. Local community assistance: Despite the rising tendency of the industrialization of food production, the bulk of the food we consume originates from smallholder farms. In contrast, it seems from a closer look at the data that these smaller farms are more resource-efficient than industrial farms, which is important in the circular economy. In essence, shifting our attention to local food production would include supporting smallholder farms in the area and giving local populations more authority. In addition, it may aid in the critical issue of rural region depopulation.

4. Creating jobs: The ability of the circular economy to provide good GDP growth and employment creation is another advantage for society. The New Circular Economy Action Plan estimates that the adoption of circular economy policies in Europe could boost the EU's GDP by 0.5% and generate 700.000 new employment by 2030. The ability to add an ethical component to employment is provided by the circular economy, which is important for society's social cohesiveness.

5. Encourage innovation: The ability to create and be creative is the world's last societal advantage of the circular economy. There will be a significant innovation push in the coming years across all industries to reinvent materials and processes to make them more circular. The circular economy might spur innovation even in fields that aren't traditionally thought of as inventive, according to McKinsey & Company.

The present food supply chain is under constant pressure to address problems like the growing population, the rising demand for food, the scarcity of natural resources like water, land, and labour, as well as the need to minimise greenhouse gas emissions.

The garbage that ends up in landfills was not further processed when things were created and consumed via the conventional or linear supply chain. The circular economy, in which goods are

created, utilised, and then discarded, has just emerged as a result of recent changes in farming practises toward sustainability. As long as it's feasible to provide a product the advantage of regeneration, it focuses on getting the most out of a resource. Although the circular economy doesn't alter the way the food supply chain is structured, it does add value to each step of the chain in an effort to improve the environment. It functions by adding additional economic value while enhancing the environment via circulation. While preserving economic development, it employs effective and newly developed management methods to reduce resource usage and environmental impact. The circular economy, in a nutshell, makes, uses, remakes, reuses, and recycles.

Humans and the environment get along with CE in food supply chains:

Economic expansion: In a circular economy, emphasis is placed on resource efficiency and sustainable agriculture practises, which results in a gain in terms of reduced resource use and increased output from the same amount of resources. The economic benefit also makes way for a specialised staff, which produces jobs, lowers the cost of raw materials, and requires less upkeep.

Food safety and wellbeing: The circular economy, which emphasises generating high-quality food while protecting the environment, promotes regenerative and organic agriculture techniques. This improves customer access to fresh foods as well as general wellness [10].

Influence of climate: Regenerative and sustainable agriculture are enhanced by circular economy to further cut emissions on a global scale. The manufacturing and processing stage accounts for around 62% of emissions, with the supply and service stage accounting for the remaining emissions. By focusing on trash reduction and reuse, CE helps to lower greenhouse gas emissions.

Protect nature: A circular economy (CE) focuses on maximizing the environment through purifying water, recycling, cutting waste, reusing, pollinating, using less chemicals, etc., while a linear economy eventually depletes resources to generate goods. These efforts have a good effect on maintaining the environment in addition to reducing the use of raw materials and trash.

Transition to CE economy challenges

Investment and education: The quantity of trash a farmer generates and the potential costs associated with not recycling or creating byproducts are mostly unknown to him. To deploy CE across the supply chain, it takes technical know-how and a specialised staff to offer the necessary skills, knowledge, and methodologies. This requires a significant initial financial commitment.

Regulation, innovation, and incentives are lacking: Uncertain government rules, a lack of implementation, a lack of innovations, a lack of assistance, etc. are all contributing factors to the poor pace of CE adoption in the food business.

Backward logistics: The circular economy mandates that items be returned to specialised facilities for recycling or reuse, which raises challenges with reverse logistics and adds to transportation costs.Supply-chain assistance: The advantages of adopting CE procedures are fully realized when the whole supply chain is moving in the same direction, says the company. The ramifications of CE have lessened in effect due to a lack of support.

Unknown duration: Products from CE have a technical constraint that makes it unpredictable about a product's phase, durability, preservation of quality, etc.

Drivers of Technology for a Circular Economy: New possibilities are emerging thanks to technology and advancements. Food waste is given value via waste valorization solutions, fostering a circular economy. By using these methods, food waste is converted into completed commodities, animal feed, or food ingredients.

Protein substitutes made from plants: The development of substitutes for meat, dairy, and fish is now feasible thanks to new technology. In order to reduce the environmental impact of the food processing sector, biotech entrepreneurs are creating meat alternatives. These either involve cellular farming or plant-based meat replacements. The Dutch start-up Meatable uses cellular agriculture to provide a sustainable beef alternative. The firm uses induced pluripotent stem cell (iPSC) technology to eliminate the need to kill an animal. It grows fatty and muscular tissue using cells taken from live pigs and cows. Then it combines the two to create a sustainable beef alternative.

Funding for agricultural and food research: A waste-valuation solution is being developed by a Singaporean company called Ugly Good. The startup purchases fruit pulps and peels from fruit juicing companies and processes them in order to extract high-value products. Waste from citrus fruit is transformed into natural cleaning products or animal feed. Additionally, the startup uses cold pressing to extract orange peel essential oils. It reduces emissions and establishes a circular economy by adding value to the waste fruit stream

Using blockchain technology to make food value chains more transparent: The ability to alter the current food systems and accelerate the shift to a circular economy is provided by digital technology. A circular economy may be driven by using sustainable food production methods with smallholder farmers and assuring ethical and sustainable consumption on the part of final consumers.

A food supply chain that is climate resilient and sustainable is guaranteed by the TraceX blockchain-powered traceability technology. Pre-harvest and post-harvest management, coupled with farm management systems, increase productivity, decrease food waste, and monitor sustainable production methods for high-quality harvests.

Advantages of the circular economy: maintains the equilibrium of the environment and human health. Fresh food availability guarantees food safety. Empowers small-scale farmers to produce food locally, increases innovation and supports GDP growth.

CONCLUSION

It is based on three principles, driven by design: eliminate waste and pollution, circulate products and materials (at their highest value), and regenerate nature. Helps to reduce our dependence on raw materials and increase the resilience and adaptability of supply chains.

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CHAPTER 15

DYNAMIC PRICING IN SUPPLY CHAIN MANAGEMENT

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Abstract:

Real-time pricing, often known as dynamic pricing, is a highly adaptable method of determining a product's or service's price. Dynamic pricing aims to enable businesses who offer products or services online to quickly modify prices in response to consumer demand. It analyses whether it is beneficial for a shop to increase or drop prices since dynamic pricing is bi-directional. Demand is also a two-way variable depending on customer demands at the same time. It benefits the supply chain when prices move along with demand.

Keywords: Dynamic Pricing, Inventory, Prices, Retailer, Supply Chain Management

INTRODUCTION

All pricing is dynamic now. Any purchase made via Amazon has been influenced by dynamic pricing in some way. The system is used for Uber surge pricing, toll road costs that increase as traffic rises, and even concert tickets. Be aware of the manner in which physical shops and online merchants employ dynamic pricing to manage supply chains and regulate inventory, even though you are undoubtedly aware of the effect this has on price. Control product price, first. It is almost hard for retailers to optimise price across all of their hundreds of goods. The majority of merchants utilise spreadsheets with built-in rules to change pricing in response to various conditions. However, retailers that employ dynamic pricing can guarantee that goods are priced fairly. Dynamic pricing systems, often at various intervals throughout the day, are driven by data and AI engines that take into account rival pricing, inventory levels, and other data to determine the best sales price. Electronic shelf labels (ESL) allow physical retailers to change prices without having to have workers spend all day adjusting prices, despite the fact that this has proved difficult to implement in physical stores. These shops are able to monitor pricing and make sure that everything is priced at the right amount by linking ESLs to an AI-based dynamic pricing engine. Next-Gen Pricing is the name we give to this union of ESL and dynamic pricing.

Manage the inventory. Unless they have an overstock problem and need to decrease prices to shift inventory, most merchants do not link inventory to pricing. As a consequence, they seldom ever consider how price could aid in inventory management. Retailers have the chance to raise prices on the remaining goods when inventory is depleted and things sell. Two goals are achieved in this way. First, future unit sales result in increased income. Additionally, it makes sure that the business never runs out of inventory. Coming into a business and discovering they are out of stock is the single most frustrating experience for a customer. Retailers may

simultaneously lower prices to shift surplus stock. Lower pricing may help electronics retailers get last year's TVs off the shelves. As fruit or dairy goods become close to expiry, supermarkets may advertise them. The system controls inventory requirements and makes price recommendations that will satisfy warehousing and stocking demands by utilizing an AI-driven dynamic pricing engine.

Control supply networks. Supply chain managers always strive to strike a balance between storing just the right amount of stock and having enough supply on hand to fulfil demand. In an ideal world, cycle stock would completely satisfy demand without requiring any inventory to be on hand. To accommodate for variable supply and demand, safety stock would nevertheless include some extra stock.

Dynamic pricing should be employed to enhance inventory supply networks despite the fact that its significance in supply chains is not well understood. It analyses whether it is beneficial for a shop to increase or drop prices since dynamic pricing is bi-directional. Demand is also a two-way variable depending on customer demands at the same time. The supply chain benefits from pricing adjustments that coincide with changes in demand. Prices that are higher help providers fulfil demand for goods that are in high demand but short supply. On the other hand, if supply is abundant, merchants may reduce prices to remove goods from the supply chain. Although they don't earn a lot of money on each item, they do well on volume and save money as they get things out of the supply chain. The supply chain benefits as a consequence. Making sure there is sufficient supply on hand to satisfy demand while not holding excessive amounts of extra stock is one of the main issues confronting supply chain management. Except for safety stock, which acts as a buffer for uncertainty on both sides of the supply-demand equation, there would be no need for further inventory in a perfect system since cycle stock would completely satisfy demand.

Supply chain management has been greatly aided by artificial intelligence (AI). To manage and reorder goods based on lead times, historical data, and seasonal demand, AI systems employ predictive analytics as opposed to intuition. These artificial intelligence (AI) systems balance supply and demand utilizing predictive demand distribution techniques, leading to cost savings in terms of storage and inventory withholding expenses. Surprisingly, supply chain management tools that use AI are seldom discussed in the market. Despite the fact that the function of price, and more especially dynamic pricing, in supply chains is not well understood, it may be utilized to maximize inventory. Dynamic pricing algorithms select the best price based on predefined criteria. When setting prices, a shoe store may wish to take into account both internal elements like customer history or inventory levels and external considerations like the competitive climate or an impending city marathon. The AI-powered pricing engine takes into consideration a variety of variables and suggests a price that would most likely result in a sale while still satisfying the retailer's standards.

The fact that price rises are not always the result of dynamic pricing should not be overlooked. Dynamic pricing is a two-way process, much like demand. The dynamic pricing engine may calculate that it is beneficial for a merchant to reduce prices to complete the deal for a variety of different reasons. Demand also vary depending on what customers require. Prices should adjust

in tandem with changes in demand. Price increases are advantageous for goods with strong demand but low supply. For merchants who can increase their revenues, this position is undoubtedly favorable. These price increases are beneficial for the supply chain because they may restrict demand growth, allowing networks to operate efficiently while maintaining and storing fewer products. On the other hand, if there is a surplus of items, merchants may transfer them around the supply chain by cutting their prices. Retailers may still profit from sales volume and eventually achieve considerable savings by eliminating products from the supply chain, even if individual item profits won't be as great. Both sides gain from integrating the retailer's category manager with the supply chain. Leaders of a major supermarket chain were troubled by the quantity of spoiled goods being thrown away each week. They spoke about various price techniques that the retailers might use to get the merchandise off the shelves before the fresh supply came and address the inventory problem.

All the information was entered into a dynamic pricing engine powered by AI, and the system suggested a pricing strategy that prioritized profits early in the cycle before dropping prices to minimize inventory later in the cycle. It takes some time to optimize the system since it depends on machine learning. Because the sales and inventory data were being utilized to manage the shop's inventory and supply chain, the grocery store was regularly lowering waste by roughly 15% after optimization was reached. The expenditures for an electronics company's retail division were also increasing at an alarming rate. They created an algorithm that gave lower prices for goods that were upsetting the supply chain and inventory control priority. The firm managed to get its warehousing expenditures under control within a few months. At that moment, decision was made to utilize pricing more strategically, especially in relation to supply chain. To assist manage the supply chain and its inventories, they created a dynamic pricing program.

Dynamic pricing has been extensively used by businesses globally as a potent tool to increase corporate profitability due to the fast growth of e-commerce. However, there are few studies that concentrate on how dynamic pricing affects the efficiency of the supply chain. We consider a Stackelberg game between one manufacturer and one online retailer, noting that compared to traditional retailers, online retailers find it easier to implement dynamic pricing strategies. In this game, the manufacturer acts as the leader and sets the wholesale price, while the online retailer acts as the follower and sets the retail price. In particular, the wholesale price and the retail price are both set and exogenous, and the manufacturer concurrently deals with the online retailer and an exogenous conventional distribution route. In order to find the equilibrium tactics, we must first solve this differential game [1]. The findings indicate that dynamic pricing would benefit the producer directly, but it will also exacerbate the double marginalization, which is bad for supply chain efficiency. Interestingly, the supply chain efficiency is best when just the online retailer sets their pricing dynamically, and it is lowest when both the manufacturer and the online retailer set their prices statically. Furthermore, if the producer sets prices consistently, its equilibrium tactics are unaffected by whether the online retailer uses static or dynamic pricing. Additionally, dynamic pricing limits the expenditure in advertising to some level.

In a two-tier supply chain, this article examines dynamic innovation and price choices. We simulate a supply chain in which a vendor sells a product to a third-party buyer, who then sells it to the consumers. Innovation is defined as efforts made to enhance a process or a product's quality. Over time, both parties may make an effort to innovate, which might improve the product's reputation in the market. Demand for the goods rises with goodwill and falls with the selling price. The product's upstream firm's unit processing cost might be favourably or adversely impacted by the innovation initiatives. The supplier initially announces its wholesale pricing and innovation efforts over time, and the buyer reacts by selecting the retail price and its innovation efforts over time. This is how we describe the situation as a Stackelberg differential game. For a central decision-maker in a centralised channel and for both participants in a decentralised channel, we find feedback equilibrium methods. Using analytical as well as numerical methods, we can get a number of helpful management insights.

By concurrently adopting the resale mode and the agency selling mode, book publishers often offer their goods to online customers via e-tailers based on the two types of books—paper books and electronic books. For a book supply chain that consists of a publisher and an e-tailer, this study builds a dynamic pricing game model on the basis of a long-term gradient adjustment mechanism. It focuses on the effects of agency fee rate and adjustment speed on the complexity of the dynamic game. We contrast the stability of the system and average profitability for dynamic centralised and decentralised decisions. The findings demonstrate that a greater agency fee rate increases the dynamic system's stability, but a higher adjustment speed causes the dynamic system to become more unstable and display a period doubling bifurcation. Additionally, when the pace of adjustment rises, the dynamic decentralized system is more stable than the dynamic centralised system. When the gaming system loses its stability, the dynamic decentralised decision results in lower earnings for the publisher and the supply chain and higher profits for the online retailer. The fact that the supply chain profit under the dynamic decentralised choice is larger than that under the dynamic centralized decision in a certain parameter zone is also intriguing [2].

Industries are starting to identify the remanufacturing of returned goods as a practical solution to the challenges of environmental responsibility, governmental laws, and growing consumer awareness. In this article, we discuss closed-loop supply chains (CLSCs), where the producer manufactures both new and remanufactured items while the retailer sells them to consumers. We take into account the following scenarios: In a centralised scenario, the manufacturer and the retailer set a steady-state price or a dynamic price with reference quality effects. In a decentralized scenario, either neither the manufacturer nor the retailer set a dynamic price with reference quality effects. With the manufacturer in charge of recovering the used products in such a CLSC, we tackle the issue by having the retailer recycle the sold copies and determine the best pricing methods. In contrast to pricing statically, the results show that dynamic pricing strategies are significantly more profitable for the supply chain and its participants. Dynamic pricing strategies with time-varying quality distinguished by reference quality are better suited for a long-term, collaborative closed-loop supply chain. Furthermore, even when adopting a dynamic price and quality in each unique scenario, the best recycling proportion is dependent on the recovery cost coefficient and shows to be consistent [3]. Dynamic pricing techniques in a

dual-channel supply chain with a producer and a retailer, with a particular emphasis on the impact of service value on choices and the perception of complexity. We investigate and evaluate how the system has changed under the influence of this long-term price forecasting mechanism. We discover that the system may become unstable with greater adjustment parameters, leading to the appearance of period doubling bifurcation or wave form chaos. In the decentralized decision, when service value grows, the system stability area initially becomes smaller before becoming bigger. The system stability region in the centralized decision decreases as service value grows. Additionally, we determine the system's bullwhip effect and examine the impact that the modification parameters have on it. We proposed a two-part tariff contract to accomplish channel coordination. We determine how the service value will affect the fixed charge in the contract. The findings indicate that when the value of the service grows, the fixed cost initially rises and subsequently falls[4]. The researcher's interest in supply chain disruptions over the last 10 years has been drawn by the serious effects of disruptive events on actual supply systems. Several ways to lessen the effects of interruptions have been created and examined in the associated literature. To the best of our knowledge, no research has examined the efficiency of pricing strategies in the context of interruptions to actual supply chains. Within this framework, a dynamic pricing strategy is created to reduce the risks of stock-outs brought on by interruptions. The idea behind the suggested strategy is to divert consumer demand from a limited supply of one product to another. A retail supply chain uses the suggested technique. The computational outcomes attest to the dynamic pricing policy's success in the face of interruptions [5]. focused on a supply chain for perishable goods that includes a seller and several retailers. These merchants are dispersed widely around a delivery area and are attentive to costs, timeliness of deliveries, and product quality. An analytical model is suggested for this issue with the goal of maximizing the vendor's anticipated long-run average profit during a cycle of shipment consolidation. The estimated optimum time strategy and freshness-keeping cost are presented based on a variety of time parameters and the upper limit expressions of the predicted long-run average profit. Through a numerical scenario, our theoretical conclusions are validated. By looking at this model's sensitivity from six different angles market situations, different kinds of perishable goods, quality standards for all retailers, cost factors, line-haul time, and vehicle capacity we may get some practical management insights [6], [7].

The demand is stochastic and price sensitive in this dual-channel supply chain with one producer and one retailer, and this article investigates a periodic review, joint dynamic pricing, and inventory issue. Manufacturer Stackelberg, Retailer Stackelberg, and Vertical Nash are three potential power arrangements between manufacturer and retailer in the dual-channel supply chain that are taken into consideration. Stochastic dynamic programming is used to create decision models that show how to modify pricing and inventory choices in each of the three power structures in order to optimize each member's total predicted discounted profit over the planning horizon. By contrasting the ideal dynamic pricing and inventory strategies under various power structures, the implications of the power structure are examined. Our main conclusions are that: I base stock levels and reduced prices are affected by starting inventory levels; (ii) base stock levels and reduced prices are subject to the same influence rules under different power structures while base stock levels are subject to different influence rules depending on the power structure; and (iii) optimal pricing and inventory decisions are a function

of base stock levels and reduced prices. According to the results of numerical instances, manufacturer and retailer chose Vertical Nash for the two-period dual-channel supply chain when the wholesale price is low, and Manufacturer Stackelberg when the wholesale price is high [8].

Using a producer and a retailer, a controlled deterioration rate, and price-dependent demand, we offer a system of combined dynamic pricing and preservation technology investment choices for degradation products in this study. The impacts of initial reference prices are also included in the proposed model since customer purchase choices often contain psychologically encoded pricing based on prior shopping experiences. The combined strategy is subsequently determined, maximizing the discounted total profit over an indefinite time horizon from the viewpoints of the store and integrated supply chain, using an optimum dynamic pricing and preservation technology investment model. Additionally, we describe the characteristics of the best pricing and preservation technology investment choices and carry out numerical studies to look into the effects of the initial reference price and different system parameters on the best strategies and discounted total profit for the retailer/integrated supply chain. We conclude with some last thoughts and recommendations for more research [9]. Many industrial companies have adopted the dual-channel green product sales model as societal awareness of the environment has grown. In this study, we take into account a two-channel green supply chain in which a single producer creates a green product and markets it both directly to consumers and via a single retail channel. Due to their differing shopping experiences, consumers in the two channels have varied impressions of the product's degree of energy efficiency. The product's energy efficiency level is a dynamic variable that changes over time. The major findings in this study are obtained by the development and solution of Stackelberg differential game problems for the dynamic and static wholesale pricing strategies, respectively. First, when more customers purchase green products via the direct channel, the manufacturer is more motivated to engage in green innovation. Second, the manufacturer typically prefers to use a dynamic wholesale pricing approach and only uses a static one when customers in both channels have reasonably positive impressions of energy efficiency. We demonstrate that the static wholesale pricing approach may be the superior option and that this results in a win-win situation for both parties by introducing the transfer payment contract. Finally, sensitivity analysis confirms the reliability of the findings and offers further management insights.

DISCUSSION

Manufacturers often sell their goods via a number of channels in the supply chain. In particular, because of the fast growth of e-commerce, many manufacturers have chosen to create electronic channels rather than being restricted to conventional channels. The New York Times reports that 42% of major suppliers offer their products straight online. As a result, it is becoming more crucial to do research on the multi-channel supply chain rivalry. The manufacturer may reduce the profit loss by establishing a direct route. Their findings also shown that when a direct route is launched, the merchant is compelled to lower the retail price in an effort to boost demand through the conventional channel. The producer may make more money by setting up a direct route that is different from the retail channel that is currently in place, and the retailer will also

profit from it. Currently, a lot of study on dual-channel management tends to concentrate on pricing tactics. The pricing issue in a dual-channel supply chain, the degree of e-commerce implementation should be restricted to a certain range; if it exceeds the threshold, the profit of the e-commerce store will be larger than that of the traditional retailer. The pricing strategy in various distribution channels when a national brand and a retail brand were in rivalry. They came to the conclusion that increasing brand loyalty is advantageous for both a retail brand and a national brand. Pricing and production choices were generated in a dual-channel supply chain with a single producer and retailer. They looked at the case of vertical integration between the retailer and the manufacturer and demand disturbances. The findings show that in a dual-channel supply chain, consumer preference for the direct channel has an impact on price choices. Pricing methods often takes service value into account. About a supply chain where two stores compete with one another on pricing and service standards while being supplied by the same manufacturer with the same product. One manufacturer and two merchants make up the value-added supply chain. They demonstrated the existence of added values and equilibrium prices under certain circumstances. Used the two-stage optimization approach and Stackelberg game to examine the best choices for retail services and pricing in a dual-channel supply chain. The impact of consumer loyalty to the retail channel on retail services and pricing was also examined. Price-setting practices in a supply chain with service value. Their findings revealed that since higher service costs may decrease demand, the store is limited in how much service value it can enhance. The strategic functions of retail services in a dual-channel market. Their findings shown that, in a dual-channel market, improving retail services may successfully reduce channel rivalry and enhance supply chain performance. The distribution of participant earnings will differ as a result of different pricing techniques, hence coordination mechanisms are required. Utilizing a contract that equalizes the best choice made by the decentralized and centralized supply chains may accomplish supply chain coordination. Contracts may be two-part tariff contracts, cooperative advertising agreements, quantity discount contracts, and so forth. Both the quantity discount and the two-part tariff contract may be used to coordinate the supply chain, however under certain circumstances, the quantity discount is preferable for the manufacturer. According to two-part tariff contracts may be used to coordinate the closed-loop supply chain, but cooperative advertising cannot. When the supply chain agents are risk-averse, looked at how to coordinate a dual-channel supply chain using a two-way revenue sharing contract[10].The oligarch competition model's structure is described by the dual-channel market. Important study areas in the long-term competition include how the game develops and how the oligarchs create a viable competitive strategy. A dynamic cooperative game on collecting pricing of a closed-loop supply chain. They investigated the intricate dynamic phenomena of the system and discovered that when the adjustment parameter increased, the system was positioned in a stable, flip bifurcation, and chaotic state. Added two no cooperative game models for closed-loop supply chains based. A two-dimensional bifurcation diagram is used in this article to understand the system's complicated dynamic dynamics. A dual-channel game model with constrained rationality; using numerical simulation, they examined bifurcation, chaos, the chaotic attractor, and other complicated phenomena. The pricing practices in a dual-channel supply chain with a fair-minded retailer. They also examined the intricate development of the system with a focus on the effects of the fair concern coefficient on the dynamic price choices.

The bullwhip effect may occur in long-term complicated games. Bullwhip effect is the term used to describe the amplification of demand fluctuation from the upstream to the downstream stages of a supply chain. The bullwhip effect has been extensively researched. The bullwhip effect was in relation to predictions using exponential smoothing. They also spoke about contrasting demand processes and forecasting methodologies. The bullwhip effect was using a two-stage supply chain with a supplier and a retailer. He also looked at the effects of autoregressive coefficients and lead time. The impact of service levels on the bullwhip effect. By using the dual-channel technique, looked at how the profit, markup margin, and inventory selections changed. A Newsvendor model was created by Yang *et al*. They analyzed the choice about delivery lead time in the direct channel and looked at inventory competitiveness in a dual-channel supply chain. A dynamic pricing approach in a dual-channel supply chain with service value, motivated by the aforementioned literatures. In order to achieve the best costs and retail services in a dual-channel supply chain with a single manufacturer, devised a framework. They looked at how pricing and profitability were affected by how devoted customers were to the retail channel and its offerings. The presence of the ideal pricing in a dual-channel supply chain with two producers. They looked at how service quality and brand loyalty affected pricing and profits. However, in a long-term dynamic pricing game, these two publications did not take the impact of service value on prices and profits into account. The complexity of the system and assessed a long-term dynamic pricing game model in a supply chain, but they did not examine the bullwhip impact of complex systems. While ignoring service value and coordination, price choices in the decentralized and the centralized decisions with demand interruptions. We respectively create a centralized decision model and a decentralized decision model. We explore the complicated changes on the price and profit of the participants in this long-term pricing decision with the modification of the adjustment parameters. In models, participants adopt various price forecasting strategies. In particular, we study the impact of service value on the stability region and long-term average profit in a long-term dynamic game in addition to the influence of service value on profits in the static game. Additionally, we investigate the bullwhip impact of complex systems and examine how adjustment factors affect the bullwhip effect. Finally, we proposed a two-part tariff contract to accomplish channel coordination. In reality, a lot of manufacturers develop direct channels to customers and sell their goods straight to them as well as to stores. Retailers provide items to customers and offer the necessary services, such Wal-Mart, Gome, and Suning. Manufacturers of air conditioners in China, like Haier and Hisense, sell their goods directly via these channels and supply retailers like Suning. Consumers may buy Haier and Hisense appliances through Suning, which also offers installation, free delivery, and other services. Long-term price rivalry is formed between manufacturers and merchants. Managers must think about how to make long-term pricing decisions and analyze how service elements affect prices and profitability. Our model offers suggestions and counsel on the choices made by the producer and store.

Currently, B2B enterprises are using dynamic pricing strategies. The use of dynamic revenue pricing as a way to increase sales and profit for B2B companies with thin EBIT margins seems to have the support of Tier One consultants. We thus want to investigate the effects on the bottom line, consumers, and teams whether dynamic-pricing skills are the new hot ticket in town and indeed the decisive element to remaining ahead of the competition.

Benefits of Dynamic Revenue Pricing in Business

1. A dynamic pricing system helps enhance pricing choices since it recalculates price goals based on real-time information at the customer/product level.

2. Dynamic pricing enables businesses to more accurately understand and anticipate when to raise or lower prices. As a result, firms may take advantage of the margin upside considerably more quickly, or decrease prices to prevent volume losses.

3. By giving decision-makers more precise information, dynamic pricing facilitates and expedites the decision-making process. In essence, a dynamic pricing system employs a number of factors to propose a price. This covers variations in product type, client type, mix, volume, and pricing. People often rely on their own knowledge and discretion.

4. Salespeople can remain on top of what are sometimes quite complicated product portfolios with the aid of a dynamic pricing system. This is big because of how much land it really covers. This often produces factual advice on hundreds of items and price that is particular to each consumer. This eliminates price speculation or hunches.

5. To acquire the ideal price for your company, it is feasible to develop a dynamic pricing algorithm at the SKU level to meet the product, offer, and industry.

For instance, a company might decide to create a pricing algorithm for a long tail of consumables or parts SKUs based on recent sales data, product lifecycle, level of competitiveness, or they might try to include a combination of customer value metrics for premium or necessary products based on what and how customers buy, the perceived value to customers, their willingness to pay, and/or the role of the product based on main differentiators compared to the competition. Many businesses use time-varying pricing to increase earnings since it is thought of as a better pricing strategy. With a time-varying reference pricing impact in various distribution channels, analyzed the best business plans and profitability for the supply chain. In a two-echelon supply chain, a Stackelberg game model with price markdown option. In their dynamic pricing and inventory strategy, took into account reference impacts in both full retail price and price discount scenarios. Supply chain deterioration products' time-varying ordering policies and dynamic prices. In a dynamic pricing dilemma that, demand was partially based on the businesses' prior price. In a closed-loop supply chain, the impact of the reference price on the efficiency of three decentralized reverse channels. a two-part tariff contract proved useful in various circumstances for coordinating the channel in a green supply chain within dynamic pricing. A dynamic pricing supply chain model was built for corporate social responsibility.

CONCLUSION

Dynamic pricing is the process of automatically and continuously modifying prices to increase profit, sales possibilities, and margins. This pricing model is now more accessible to a larger variety of businesses than it was in the past.

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CHAPTER 16

IOT ON SUPPLY CHAIN MANAGEMENT

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Abstract:

The information aids them in increasing real production, enhancing raw material quality, reducing energy use, and ensuring profitability. Internet of Things (IoT) solutions are being introduced by manufacturers to continuously monitor production processes and equipment health. IoT enables supply chain managers to link up machines, cars, and other items for real-time work status information. This may provide a complete image of the supply chain, from the producer to the client through the warehouse.

Keywords: Circular Economy,Communication System,Internet of Things (IoT), Product, Supply Chain Management.

INTRODUCTION

Supply chain management (SCM) refers to and includes all management activities that are connected to the movement of goods within an organization from the time that raw materials are purchased to the distribution of finished goods to the final consumer in order to ensure that costs are kept to a minimum. Product development, logistics, production and manufacturing, sourcing, transportation, inventory and warehouse management, and shipping are all included in supply chain operations. However, firms nowadays encounter several difficulties when it comes to supply chain management. Among the difficulties are: Lack of asset visibility, ineffective transportation or logistical management inefficient stock handling, incorrect data handling and inadequate supply chain risk management[1]–[4].

One of the best developing options to address these problems has proven to be the Internet of Things. The Internet of Things is a network of wirelessly linked technological gadgets that may be accessed online from any location. Things in this context refer to items having an IP address and the capacity to gather and send data across a network without the aid or involvement of a human. IoT applications in supply chain management have enormous promise. It facilitates free communication between things and improves logistical control. It may lead to improved process effectiveness and clever methods of handling things. Additionally, it helps with real-time inventory visibility, which improves organizational transparency. On the one hand, IOT will help SCM by providing real-time visibility so that managers can monitor the inventory at any given moment.

Firms must participate actively in a larger supply chain that involves a network of other businesses and contacts in order to succeed in the current business environment. As a result, supply chains operate in a constantly shifting environment and are open to a wide range of hazards on all fronts. This habitat is a dynamic terrain that is influenced by several elements. Many supply networks are exposed to several global hazards because they span large geographic

regions. Customers are becoming more and pickier in terms of product customization, cost, and service quality. Due to the high clock speeds in many sectors brought on by the quick changes in technology and the ongoing introduction of new items to the market, product complexity is also rising. In addition, the external environment is quite dynamic because to economic, social, and ecological elements including the cost of energy, the pricing and availability of raw materials, and currency exchange rates.

Companies need to be highly nimble, have a high degree of resilience, risk mitigation skills, and structural flexibility that enable quick reaction to these issues in order to thrive in such a complicated environment. Structural flexibility refers to the supply chain's capacity to adjust to significant alterations in the external business environment. However, flexibility and resilience have a higher coordination cost and additional expense in the form of additional resources like buffer inventories and extra capacity. Businesses need to have great visibility of the whole supply chain, the requisite velocity to react swiftly to changes, and efficient coordination with suppliers and customers in order to strike a balance between the needed degree of resilience and flexibility and the cost of obtaining it. The four guiding principles for supply chain managers, or the "4Rs," were outlined as responsiveness, reliability, resilience, and relationships[5], [6].

IT has always been and will continue to be a crucial enabler for successful supply chain management (SCM). It is crucial in assisting supply chains in overcoming the obstacles posed by a constantly changing environment and a wide range of hazards at all levels. Due to its capability of internal integration of multiple operations and, more critically, external integration with suppliers and consumers, IT has significantly changed the character and structure of supply chains. This has been accomplished through strengthening data acquisition, transmission, and communication, which has enabled efficient decision-making and improved supply chain performance. One of the most recent IT innovations, Internet of Things (IoT), is a new IT revolution that is bringing about a paradigm change in many domains, including SCM. By enabling human-to-things communication and autonomous coordination among "things" while they are being held in a facility or being transferred between various supply chain entities, the Internet of Things (IoT) raises the bar for supply chain communications. The potential to address SCM issues more skillfully is enormous given these additional skills. In order to address numerous SCM difficulties, IoT offers new degrees of supply chain visibility, agility, and flexibility. When successfully gathered, analyzed, and transformed into valuable information, the data produced by smart devices may give unparalleled insight into all facets of the supply chain, giving early indications of internal and external conditions that need correction. The supply chain may achieve new levels of efficiency by promptly responding to these indications.

The methods for gathering and processing large data, as well as the delay between data collection and action, were what was missing up until this point, not the accessibility of information. Supply chains will be able to respond to changes in real time thanks to IoT, which will shorten the time between data collection and decision-making. This degree of agility and reactivity has never been achieved. IoT will also make it possible to remotely control supply chain operations, improve partner cooperation, and may provide more precise data for more effective decision-making.

With a flurry of studies addressing cutting-edge applications in SCM and logistics, IoT research has swiftly expanded as supply chains have gotten smarter, more technologically driven, more interwoven. To explore IoT, several academics have started employing bibliometric methods. As

an example, have recently investigated on big data and IoT applications in the context of the circular economy. Although their investigation was primarily beyond the realm of SCM and logistics, it did draw on 30,557 and 32,550 papers, respectively, that were connected to the circular economy and big data/IoT. A bibliometric study was conducted by the security features of IoT-enabled smart grids. A review and bibliometric analysis were done to look at the usage of IoT in food safety. They discovered that IoT is a relatively new strategy for ensuring food safety, and that the technology is mostly used to track location, temperature, and humidity. Although the writers utilized several bibliometric methods, the authors' research was only concerned with the food business.

A worldwide network of intelligent gadgets called the Internet of Things (IoT) combines the physical and digital worlds. Although the Internet of Things (IoT) is said to be a cornerstone technology for the newly emerging Industry 4.0 era, there is no empirical data on IoT utilization in supply chain management. Therefore, utilizing interviews with managers from the Australian retail sector based on grounded theory, this research explores the benefits and constraints of IoT deployment in supply chains. The IoT implementation enhances data gathering, partner communication, business intelligence, and visibility of goods movement, according to the thematic analysis conducted using NVivo. However, merchants encounter difficulties because of a lack of top management effort, the expense of acquiring new technology, stakeholders' resistance to change, a refusal to share data, and a lack of system compatibility across partners. The study provides a proof-of-concept for IoT advantages that support IoT-related investment decisions, illuminates adoption difficulties, and presents hypotheses for further investigation.

One of the key pillars of manufacturing and industrial organizations, supply chain management's intelligence may support business intelligence. To this aim, using cutting-edge technology to make it intelligent is always a worry. The smart supply chain makes use of cutting-edge solutions to boost performance, increase quality, and simplify the decision-making process. One of the essential elements of the IT infrastructure for the creation of smart supply chains with a high potential for system sustainability is the internet of things (IoT). In addition, one of the most significant sources of big data production is IoT. Big data and data analysis techniques are becoming more popular as a comprehensive and potent means of improving decision-making and raising productivity. The supply chain in the FMCG industry is being studied as a specific example in this article in an effort to investigate informative supply chain development options and to give a comprehensive analytical framework for creating a sustainable smart supply chain using IoT-based big data analytics. The framework that is being presented is based on the IoT implementation approach, with a focus on the usage of input big data and expert evaluations. This may result in wiser manufacturing choices given the nature of the FMCG sector.

Supply chain management (SCM) is becoming more dynamic and sophisticated. In order to meet consumer demands in the supply chain, radio frequency identification (RFID) and the Internet of Things (IoT) are anticipated to play a crucial role. The combination of RFID and IoT in this study is referred to as RFID-IoT. By linking IoT devices through the internet, RFID-IoT aims to establish automated sensing, seamless, interoperable, and highly secure systems. The authors of this research have conducted a comprehensive evaluation of the literature on the use of RFID-IoT in supply chain management. This paper's contribution is a study of the state-of-the-art literature currently available and any emerging trends on the use of RFID-IoT in SCM. To improve the effectiveness of the management system, increase production, and save costs, a thorough, in-depth review of current literature is required. The present issues with the examined

papers' deployment of RFID-IoT in the supply chain are also explored in this study. Four key SCM viewpoints have been used to develop the conceptual framework model: product production, shipping and distribution, inventory, and retail store. The review's emphasized conclusions and suggestions could spur further work on RFID-IoT technology development in the future.

The direct delivery of medications from the producer to the end user is the primary priority of today's healthcare system. The parties in the pharmaceutical supply chain, including distributors, producers, wholesalers, and customers, mix to some extent. Monitoring the supply chain's temperature and preventing the use of counterfeit drugs are the most difficulties. Many medications and vaccinations only work at certain temperatures. The medication ceases to function as intended if exposed to temperatures over this range. In this study, a block chain system based on Internet of Things (IoT) sensors is developed that monitors and traces medicines as they slowly move through the whole supply chain. On the one hand, supply chain management is greatly aided by emerging technologies like block chain and Internet of Things sensors. On the other hand, they also provide brand-new security risks for IoT devices with limited resources and block chain scalability problems to manage this IoT sensor-based data. In this work, we improve traditional block chain systems to make them appropriate for IoT-based supply chain management, with the application of these new promising technologies to a medicine supply chain serving as a secondary emphasis.

A. S. Sangeetha *et al.* [7] Block chain will improve the efficiency and accountability of supply chains and have a beneficial impact on everything from payment to distribution to storage. Due to its immutability, tamper-resistance, and hash proof security properties, block chain is being used to close the supply chain visibility gap. Integrating block chain with IoT improves supply chain management's traceability and verifiability and significantly reduces fraudulent activities including bribery, money laundering, forgery of checks, sanction breaches, and misrepresenting products and services. To lessen the incidence and effects of fraud in supply chain management, block chain may be used to cross-check the identity, authentication, and validity of IoT devices. Several international supply chains have been impacted by the SARS-CoV-2 pandemic outbreak. Block chain technology may be used to address the supply chain issues that SARS-CoV-2 disclosed, according to the Geneva-based World Economic Forum. Incorporating block chain technology and the Internet of Things, this article examines contemporary supply chain management approaches.

Arun Aryal *et al.* [8] The goal of this research is to shed light on how big data analytics and the Internet of Things (IoT) have evolved through time in terms of our knowledge of and use of disruptive technologies. The study also looks at the differences between supply chain research and allied areas' approaches to handling disruptive change. Design/methodology/approach: This research uses a four-step systematic review methodology, which includes the gathering of relevant literature, descriptive analysis, category selection, and material assessment. The latent semantic analysis approach, which enables faster, more accurate, and more consistent content analysis, was used for the last step of analysing pertinent topics and trends in the literature. Findings: The empirical study found major research trends in big data analytics and IoT across two time periods, with research showing stable increase by 2015 and the fast expansion subsequently. This review's most important result is that supply chain networks, systems, and performance intersect with customer service, support, and support for big data. Major IoT research issues have shifted from broader topics like corporate information management and

supply chains to more focused ones like supply chain design, model, and performance. Originality/value: The authors want to spot significant patterns in the study of disruptive technologies throughout time in addition to raising awareness of this research methodology.

Theofilos D. Mastos *et al.* [9] The implementation of Industry 4.0/Internet of Things (IoT) technologies offers prospects for more sustainable management, as has become clear to businesses as a result of the fourth industrial revolution and the digitization of supply chains. For all the organisations involved in the supply chain, but notably for scrap metal producers and waste management firms, managing scrap metal sustainably is a difficult issue. Despite the fact that scrap metal management is often ineffective owing to a number of reasons, such as collecting procedures, communication, and market constraints, which have major negative effects on the environment and the economy. This study aims to give proof of how an IoT solution affects the performance of sustainable supply chain management (SSCM). In order to demonstrate how the adoption of a cutting-edge industry 4.0 solution has the potential to increase sustainability both at the firm level and at the supply chain level, a case study from a scrap metal manufacturer that works in the lift industry and a waste management business is given. The automation of monitoring and negotiating processes for the generated scrap metal are direct advantages of the offered system. Indirect benefits of the suggested strategy include the optimization of reaction times, decrease of CO2 emissions, and resource availability. The findings support the Manavalan and Jayakrishna (2019) paradigm for evaluating SSCM for Industry 4.0 and show that Industry 4.0 solutions have the potential to enhance supply chain management's economic, environmental, and social sustainability, among other things. By bridging the gap between theoretical advancements and actual situations in the realms of industry 4.0 and SSCM, the current research adds to the body of literature. Additionally offered are managerial implications, restrictions, and potential future study areas.

DISCUSSION

The supply chain management and logistics operations may be considerably improved with the use of Internet of Things (IoT) solutions, delivering transparency and cost-effectiveness that is only possible with the use of this cutting-edge technology.

Here is how IoT works in SCM for those who are unfamiliar. The gathering of real-time data on the items being kept and carried, inventory level and shipping status, environmental conditions in warehouses and vehicles, etc., is made possible by internet-connected devices (such as image, temperature, humidity sensors, GPS trackers, etc.). After that, the raw data is processed, saved, and analyzed on the cloud to allow for continuous end-to-end supply chain monitoring and quick response to any changes. For instance, if sensors find that the preset temperature of cold storage facilities has been exceeded, the control software instructs the actuators to raise the temperature and alerts supply chain managers.

IoT's advantages for logistics and supply chain managementA multi-stage process, supply chain management often includes a number of parties. Each player may take use of particular IoT advantages. IoT solutions are used by raw material suppliers to monitor their technological processes. For example, in farming and agriculture, they collect real-time data on crop conditions and livestock health, while in forestry, they keep an eye on fires and logging operations, and in the oil extraction industry, they analyse the composition of the oil in the pipelines. The information aids them in increasing real production, enhancing raw material quality, reducing energy use, and ensuring profitability.

IoT solutions are being introduced by manufacturers to continuously monitor production processes and equipment health. Continuous monitoring aids in identifying bottlenecks and making the appropriate modifications, so minimising downtime, raising asset utilisation, and enhancing production effectiveness. IoT also helps with sustainability since it can be used to measure energy and water use, as well as to monitor emissions levels and adhere to environmental requirements. As logistics operators get real-time information on the location and condition of every asset, IoT improves transparency and accuracy in the industry. They may monitor and improve the whole delivery route using this data in the event of modifications or delays. By identifying deviations from ideal shipping circumstances, IoT systems also assist in managing cold chains and ensuring the safety of perishables. The visibility and precision of warehouse operations are increased thanks to the Internet of Things, which also makes inventory monitoring easier. IoT technologies help to preserve perishable items by monitoring storage conditions.

IoT solutions improve the picking accuracy and handling efficiency of items during pickup and loading and unloading, which benefits retailers. To maximise inventory visibility, an IoT solution may assist in tracking things throughout shelves. It can also be used to monitor shop traffic and improve product presentation and space use.

Supply Chain and the Internet of Things: Supply chain management has been transformed by IoT devices (SCM). Understanding where items are, how they are being held, and when they may be anticipated at a certain place is considerably simpler.

Verify the Position of the Goods at Any Time: IoT gadgets might be fastened to certain storage containers, raw materials, or finished goods. The Internet of Things gadget will send its position, which GPS satellites can receive and use to monitor the movement of products.

Monitor Movement and Expected Arrival Times: Predicting how things will move through the supply chain is made considerably simpler by tracking movement speed and product traffic flow. It is possible for suppliers, producers, and distribution centres to set up for the arrival of products, which shortens handling times and guarantees that resources are processed quickly.

Keep an eye on how raw materials and finished goods are stored.

Food and chemicals are two items that need proper storage conditions. Specialist Internet of Things (IoT) devices can keep an eye on things like temperature, humidity, air exposure, light intensity, and other environmental variables. If certain criteria are crossed, these gadgets may even sound an alert. This greatly facilitates reducing loss and tracking the quality of items along the supply chain.

Streamline the Difficulty of Goods Movement: IoT devices may use goods monitoring and route planning to determine where and when deliveries are delayed. This makes it possible to prepare for emergencies and take detours to quicken the supply chain.

Find Items in Storage: When products are at a distribution centre, IoT devices may still be attached to them. This provides precise identification and administration of items while also making it much simpler to locate individual products inside a big warehouse. As soon as the goods are received, administer them. SCM can certify the precise arrival time of items thanks to verified tracking via IoT devices. Other administrative actions, such as requests for onward delivery or supplier payments, may result from this.

Supply Chain Management Effects of the Internet of Things: Every major sector, including retail, transportation, banking, healthcare, and energy, has benefited greatly from the Internet of Things. Processes like supply chain are where the Internet of Things best demonstrates its promise. Applications for management, forecasting, and supervision aid fleet managers in increasing distribution's operational effectiveness and decision-making openness. The Internet of Things may be used to enhance every aspect of the intricate supply chain process. You'll discover the effects of IoT on supply chains and discover the apps employed in this sector in this article.

IoT applications for supply chain management: Some of the primary goals for IoT adoption in supply chain management include tracking and monitoring. Warehouse and fleet managers can monitor their inventory and freight thanks to technology. However, the Internet of Things offers more than just the possibility for asset management. Here are several other benefits of IoT in SCM:

Monitoring locations in real time: Managers have access to a consistent stream of real-time data on the product's location and the environment around transportation thanks to the Internet of Things. You may keep track on the delivery of both finished items and raw materials, and you will be informed if the product is transported in the incorrect direction.

Monitoring of storage conditions: Environmental sensors allow management to monitor cargo conditions and take immediate action when anything changes. For instance, one of the most popular IoT supply chain systems collects information on pressure, humidity, temperature inside vehicles, and other variables that might jeopardise the integrity of the goods, and then automatically adjusts the environment accordingly.

Project the product's travel and arrival: IoT devices and data analytics systems are used by managers to enhance the decision-making process and boost the accuracy of delivery estimates. Real-time tracking enables businesses to track products throughout shipping, anticipate delivery, and forecast and lower the risk of delays.Find items at the storage facility: One of the top warehouse technology developments is the integration of IoT-based supply chain management solutions. Numerous advantages include improved inventory management, staff safety, and greater warehouse process efficiency. Employees on-site, for example, may simply discover items and move quickly to the precise aisle for a certain product thanks to real-time location trackers. In this situation, the Internet of Things makes it feasible to create smooth performance and workflow that would not be achievable otherwise. IoT also becomes a stepping stone for full-scale warehouse automation with little to no human oversight when paired with artificial intelligence.Enhance your emergency preparations: Supply chain managers may design routes with the use of IoT and data analytics, taking into consideration traffic, weather, potential accidents, and other delays-causing events that may occur along the way. The Internet of Things collects all the data required to create adaptable backup plans and identify the source of any current delays. Supply chain managers may get real-time warnings from the system, which accelerates risk mitigation.IoT implementation in supply chains across many industrial sectors: The area of supply chain management has several facets. Numerous procedures take place concurrently during the delivery, therefore managers must streamline them. The technology that aids in developing broad perspectives and producing intricate but useful frameworks for operational efficiency in this area is the Internet of Things. Technology affects several elements of supply chain management, including shipping, storage, logistics, and communication.

1. Asset management IoT solutions make asset management and monitoring easier. Managers may now completely depend on software to update the status of all assets, without the need for human data entry or conventional inventory devices. Similar to asset tracking in retail, connected technology like sensors, RFID tags, beacons, and smart materials make it easy to track every item and give supply chain managers quick access to crucial information about every delivery, such as the parcel's contents, storage instructions, and other details.

2. Automatism: For larger retail and logistics organisations, managing enormous warehouses is where this technology's full potential is realised. The Internet of Things has several uses in supply chain management, including inventory drones and linked equipment for remote monitoring and control of warehouse conditions. Warehouse managers benefit from the human-technology synergy in manufacturing and supply chains by increasing productivity, reducing costs, and strengthening resilience.

3. Enhanced resource administration: One of the most significant advantages of IoT in the supply chain is machine intelligence and technology's capacity to identify problems or opportunities that humans won't be able to notice such as resource leakage, inefficiencies, potential equipment malfunction, and even the future. In actuality, networked systems collect the data necessary for predictive analytics at various supply chain phases (detecting equipment failure, predict maintenance, plan load, etc.). Predictive analytics is the next big thing in supply chain management, and it is extensively employed in many different sectors. Managers of supply chains and warehouses can only considerably reduce downtime and save a lot of money by being able to predict system breakdowns[10].

4. Discretion: The use of the Internet of Things in logistics increases the effectiveness of communication across the whole supply chain. Managers may follow drivers and shipments to check on internal regulations compliance, product storage best practises, and delays between the warehouse and the customer's doorstep. Managers may engage with end customers and keep them informed by having access to real-time location, productivity, and environmental data, resulting in better, more individualised service.

5. Sustainability: IoT is one of the technologies that may assist managers in adhering to the most recent environmental laws and emission limits, as well as a sustainability enabler in a smart supply chain. They can now receive a highly accurate view of how resources like electricity and water are utilised, adapt green methods to fleet management and shipping, and integrate environmental activities at scale thanks to various IoT sensors for supply chain management and asset monitoring (renewables, electric vehicles, energy-efficient spaces).

IoT benefits for supply chains: More companies are looking to take use of technology in the supply chain as a result of the Internet of Things' rising popularity. Here is a summary of the advantages of IoT in SCM in case you're wondering how it might increase your company's productivity and save operational expenses.

Greater speed: The whole supply chain speed is significantly increased by smart route-planning tools and IoT tracking systems. By incorporating these technologies into routine operations, managers may make decisions more quickly, reduce delay risks proactively, and overall increase the effectiveness of finding items in the warehouse.

Increased precision: Comparatively speaking, open platforms are quicker and simpler to use than closed ones. Companies can guarantee all stakeholders participating in the supply chain lifecycle will have access to pertinent data and be able to quickly resolve concerns by developing a cloud-based IoT solution. Additionally, online and mobile solutions for various users (workers, managers, operators, and consumers) enable them to make use of the insights and construct plans and various scenarios that are pertinent to their positions and requirements.

Increased adaptability: IoT gives managers thorough insights on the flow of commodities, which helps merchants and supply chain managers determine how many units of each product to purchase. By enhancing asset monitoring, shipping, and on-road navigation with high accuracy, the Internet of Things lessens the effect of human mistake as well.

Improved segmentation: Retailers may establish effective strategies by combining IoT and supply chain management to better understand their goods, consumers, and demand. Data gathered during the course of the product cycle aids in market research and allows for product segmentation with the target market in mind.

Improved effectiveness: Many linked systems focused at workers are made possible by IoT. Smart glasses and other tools make it easier for warehouse employees to get instruction so they can complete tasks faster. IoT also collects data on efficiency and raises awareness of resource and labour management. Supply chain managers will make sure that everyone engaged in the delivery gives their best effort thanks to technology.

IoT supply chain management challenges: There are unique difficulties in implementing IoT in supply chain management, but they may be overcome with the proper vendor and technology.

Skills Gap: Training and education regarding security procedures and rules for utilising corporate IoT-based supply chain management systems are required for warehouse employees and truck drivers.

Data storage difficulties: The abundance of data that IoT devices produce is both an opportunity and a problem. The amount of server power required to store and process the gathered data must be sufficient. To draw the appropriate conclusions, data governance regulations are also necessary.

Security risks: need a safe IoT infrastructure before moving to fully linked systems. External assaults and data breaches may be caused by data vulnerabilities. Managers may reduce security risks by integrating machine learning (ML) and cryptographic hardware monitoring. IoT platforms and devices depend largely on the availability of the internet as well as other short-range technologies like Bluetooth and NFC. This problem will automatically be resolved once 5G becomes accessible and internet coverage expands.

CONCLUSION

Most recent advancements in the use of IoT in supply chain management and diverse supply chain activities. As a result, the study examined IoT in an SCM framework, listed its primary technological enablers, and established an SCM definition of IoT. IoT programs centered on crucial supply chain procedures. IOT's effects on supply chain management, it is clear that IOT contributes to supply chain management by bringing real-time visibility and transparency. It is simple to maintain inventories and keep an eye on the manufacturing process thanks to the

connectivity of several production-related equipment. By preventing duplication, theft, and any variation in quality and quantity, it eliminates supply chain management inconsistencies.

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CHAPTER 17

AGILE SUPPLY CHAINS IN SUPPLY CHAIN COORDINATION

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Abstract:

Speed, cost effectiveness, responsiveness, adaptability, and productivity are the main goals of an agile supply chain while producing and delivering commodities. When taken as a whole, they describe what an agile supply chain is: a method of product distribution concerned with completing tasks fast, saving money, responding to customer and market expectations, retaining flexibility, and preserving record-high productivity. Agile supply chains use both predicted data from supply forecasts and real-time data to inform decision-making in day-to-day operations. When they work together, they provide a more robust process that saves money for both enterprises and customers, minimizes the waste of surplus inventory, anticipates possible shortages, and completes all of this work swiftly and effectively. Flexibility is essential for an agile supply chain.

Keywords: Agile Supply Chains,Industrial Marketing, Lean Concepts, Product, Supply Chain.

INTRODUCTION

With each passing day, the contemporary supply chain becomes more and more complicated. The supply chain is changing as a result of digitization, a focus on fundamentals and change, augmented reality, artificial intelligence, and many other aspects. Lean manufacturing and supply chain management were formerly thought to be the most efficient approaches. The agile supply chain, a new idea in supply chain operations, is swiftly taking the place of the overused phrase. Unfortunately, a lot of supply chain organizations do not fully comprehend the extent of agility, how it differs from a lean supply chain, or how it works. Let's examine how the lean supply chain is being swiftly replaced by the agile supply chain.Supply Chain Agile: Using responsiveness, competence, adaptability, and rapidity to control how successfully a supply chain entity functions on a daily basis is what is often meant by the term "agile supply chain." In contrast to the lean supply chain, the agile supply chain, as described by Martin Christopher in Industrial Marketing Magazine, uses real-time data and updated information to take advantage of current operations and real-time data against demand forecast, which aids in increasing the overall efficiency and productivity of the given entity. Focusing on preventing possible shortages and getting rid of overstocked inventory is another important advantage of agility in the supply chain. In a way, keeping inventory at excessive levels was a common reaction to the lean idea. Since the lean philosophy focuses on improving processes, many supply chain organizations often found themselves with a large inventory of goods. Unfortunately, changes in the economy, customer demand, and increasing product customization have resulted in wasted expenses when inventories became ineffective or unusable over time.

Agility Differs Fundamentally from Lean Concepts: The aforementioned details provide light on how agile and lean supply chain approaches are different from one another. A genuine understanding of supply chain agility, however, must take into account how lean principles are used in the agile supply chain. The organization has eliminated unnecessary expenses along the road for supply chain entities that have adopted or implemented lean ideas in supply change management. For instance, abandoning ideas in the supply chain would refer to the employment of a computerized system to automatically create orders and robots to select these items. The lean supply chain fallacy, however, is based on the fact that this data from the lean supply chain is not leveraged to provide a predictive, quantitative analysis of what will be required in the future. As a consequence, the supply chain often has overstocking problems and is unable to provide a nearly flawless level of visibility. The agile supply chain can also adjust to situations that are changing quickly, like the economics, personalization, trends, and client needs, among many other things. Supply chain entities may effectively traverse the turbulence that may arise and manifest itself throughout the process of production, shipping, and the reverse logistics supply chain by building a supply chain capable of responding to such difficulties right away.

Benefit of Supply Chain Agility: Supply chain processes might alter according to agility principles. The supply chain may have enhanced staff productivity by using lean techniques. However, adopting agile supply chain solutions with real-time data modular and raw material reserve formulations must be done as near to the finished product as feasible, according to GT Nexus and Kurt Salmon. Additionally, agility enables supply chain participants to collaborate in order to manufacture the quantity of goods that is required each day, rather than depending on estimates for the next quarter, month, or year. Agile solutions essentially include taking the lean supply chain and enhancing it so that it can react and encourage interactions between suppliers, customers, and manufacturers.

The supply chain business benefits from agility in several ways. Supply chain entities can adjust to great diversity and abrupt variations in volume by retaining agility. Unfortunately, this suggests that even if certain ingredients are accessible, the supply chain may not be able to manufacture a large quantity of items. Because of this, supply chain organizations who have adopted agile supply chain solutions are aware that real-time data implies a rapid shift in demand might happen without notice, endangering the connection between suppliers. These organizations have thus looked for methods to provide the same final product while yet producing a unique outcome for each purchase. For instance, a supply chain organization in the fashion or textile printing industries could wait to print the real materials until after a customer has actually purchased those items. However, this suggests that printing on the materials wouldn't be feasible before an order was made; as a result, the printing operations would need to occur as near to the location where the order would be fulfilled as possible. In order to effectively fulfil local demand, this crucial stage in the agile supply chain ultimately returns to tearing down organizational silos and inflexible structures.

The growth of the Asian market and production capacity, particularly in the Asian market and production capacity, and the decline in the production share of western countries, especially the USA, have necessitated a review of current production practices in tandem with globalization

and socioeconomic developments. A request for a thorough report was made during this search by intellectual circles. Iacocca Institute produced a study titled "21st Century Manufacturing Enterprise Strategy" in this regard. Agile manufacturing has reportedly been identified as the mode of production that will succeed in the new century, especially in light of the examination of the conditions and issues of the era and the US manufacturing industry's declining competitive position in comparison to Asia and other markets. Customer-oriented assessment of goods and services is described as having the capacity to adjust to quickly changing market expectations, to thrive in competitive marketplaces where unanticipated changes occur, and to continue developing. Agility is the capacity to take the required precautions against unforeseen challenges and hazards that have not previously been faced, and to see these circumstances as opportunities. Additionally, it is the company's capacity to use its resources swiftly and adaptably in order to both anticipate and react to opportunities and problems that arise in the internal and external environments of the business. Despite being referred to as a capacity, it has evolved into a management philosophy with the growth of the idea. Flexibility and agility in manufacturing have become essential due to market volatility, consumer expectations, and the desire for individualised goods.

LITERATURE REVIEW

Ping Lou *et al.* [1]The purchase, transformation, and delivery of raw materials and products take place within a global network of suppliers, manufacturers, warehouses, distribution centres, and retailers. The capacity to swiftly and dynamically adjust a supply chain in response to changes in market demand is one of the most crucial characteristics of an agile supply chain. The agile supply chain is recognised as one of the key technologies of agile manufacturing based on dynamic alliance, and principles and features of one are described in this study. Additionally, the significance of coordination in the supply chain is emphasised. Based on the multi-agent theory, a generic architecture for agile supply chain management is provided, in which the supply chain is controlled by a group of intelligent agents for one or more activities. The agents of the supply chain management system are coordinated. A contract net protocol together with case-based reasoning for coordination and an algorithm for job allocation are described.

S. M.Sohel Rana [2]Examining significant factors that affect the responsiveness of the retail supply chain is the goal of this research. Through the use of random sampling and a structured questionnaire survey, data for the research have been gathered. Data analysis has been done using the partial least squares structural equation modelling (PLS SEM) method using smart PLS 2.0M3 software. According to the survey, the importance of suppliers, their use of IT, inventory control, and coordination all have a big effect in how responsive the retail supply chain is. The results also demonstrate that an agile supply chain strategy moderates the link between the usage of IT by suppliers and the responsiveness of the retail supply chain. With a focus on analysing the factors that influence the responsiveness of the retail supply chain, this research has implications for both commercial organisations and theoretical elements.

Baoyang Ding [3]Utilizing Pharma Business 4.0's new technologies makes it easier to create sustainable value, creates a more adaptable, intelligent, and personalised pharmaceutical industry, and ultimately paves the way for pharma firms to gain competitive advantages. To

match future operations and management of the pharmaceutical goods over the full life cycle, a more sustainable pharmaceutical supply chain (PSC) should be put in place. This study's major goals are to identify possible PSC sustainability challenges and look at how Industry 4.0 may be incorporated into sustainable PSC paradigms. This report conducts a systematic evaluation of 33 pertinent publications on sustainable PSC and Industry 4.0 that were published in peer-reviewed academic journals during a ten-year period (2008–2018). According to content analysis, the main obstacles preventing the PSCs from incorporating sustainability are: high costs and time requirements, a lack of knowledge and training, the enforcement of laws, the scarcity of financial incentives, ineffective collaborations and coordination within the PSC, a lack of objective benchmarks, and poor end-user awareness. Four aspects of these barriers can be resolved by the technologies and innovations based on Industry 4.0: improving the PSC's flexibility for patient-centric drug supplies; enhancing the efficiency of coordination and communication across different entities within the PSC; reducing waste and pollution at various stages; and empowering supply chain managers with more autonomy in their decision-making. According to the results of our analysis, future studies should concentrate on the following topics: cross-linking coordination and cooperation, environmentally friendly end-of-life product disposal, proactive product recall management, new benchmarks and measurements of sustainable performance, new regulation system design, and effects of incentives for sustainable activities.

Daoping Wang [4]Based on the quick development and dissolution of reconstruction and adjustment, the Agile Supply Chain Dynamic Alliance. Integrity of the agile supply chain may enhance the mechanism for corporate coordination and the interaction between supply and demand, give direct market intelligence and wide-ranging sales channels, and increase overall company efficiency. The paper-based Web services on the basis of a framework for dynamic collaboration and used the system to design knowledge service platform in order to better use the knowledge of agile supply chain to win advantage for enterprises. Agile Supply Chain Dynamic Synergy is an important factor limiting its development.

Zhi Xiang Chen [5] The technology and operational methods have received most of the attention in supply chain management literature, but performance assessment has received less attention. A performance measurement method for supply and demand coordination built on agile supply chain management is developed based on the examination of previous researchers' accomplishments and the investigation of specific businesses. All measures have been given out quantitative calculation methods, and they have all been divided into various levels and groups in accordance with the four different types of supply chain coordination activities: logistics coordination, information coordination, cash flow coordination, and workflow coordination. In the realm of supply chain performance research, this is a well-designed and methodical performance measuring system. Most policies are first proposed. The solution will support agile supply chain management's efforts to coordinate supply and demand more effectively.

Lili Qu *et al.* [6]Semantic Web, the next-generation of web technology, has the potential to enhance the capacity for autonomous information processing. The semantic Web services make it possible to describe and engage with Web services on a semantic level by introducing supply chain ontology and integrating Web services with semantic web. The suggested method requires

the supply chain to integrate diverse corporate application systems and complicated business process dynamic composition. Based on the suggested semantic Web services and SOA, an agile supply chain coordination and integration system framework is built. This newly created hierarchical framework has the benefits of loose coupling, cross-enterprise, cross-multiplatform systems, heterogeneous systems interaction, and agile supply chain system reconstruction, which is a workable and efficient solution to implement the attributes of agile supply chain, including agility, virtualization, and reconstruction.

Norman M. Sadeh *et al.* [7]With time, it's anticipated that the global Internet economy will give birth to more flexible business models that dynamically build up new supply chains in response to shifting market circumstances and customer needs for highly personalised goods and services. Enterprises must have the capacity to quickly assess new business prospects and dynamically discover the best prospective supply chain partners to take advantage of them in order to apply these "e-supply chain" strategies. In order for the resultant value chains to function successfully, they must also be able to coordinate the production and distribution of products and services. In this paper, we propose MASCOT, a dynamic supply chain management decision support environment based on agents. When users are dispersed across various organisations and levels within a single enterprise, MASCOT agents assist them in collaborating on the creation and revision of supply chain solutions as they assess various business opportunities (such as requests for proposals from potential clients) and sourcing options. This article also covers novel coordination protocols that were created as part of MASCOT with the goal of maximising the effectiveness of limited capacity scheduling functions across the supply chain. Empirical findings that quantify the advantages offered by these novel procedures under various loads and supply chain configurations are given.

Michael Pearson *et al.* [8]provided an example of a fresh theoretical advancement used to support decision-making in a steadily growing commercial industry. Agile supply, in which new goods with short life cycles and high margins are sold in small amounts, is increasingly carried out via an intricate global supply chain network. In such a supply chain network, we use an equilibrium solution, which functions through constrained coordination and cooperation along network edges (links). Instead of network nodes, the linkages make up the stochastic modelling entities. To discover, characterise, and anticipate distinctive behaviour in supply chain networks, we use newly developed phase plane analysis. The phase plane charts profile the inventory flow and show uncontrolled situations. They maintain quality inside the network and shrewdly monitor how the network changes in response to shifting variability. The approach may be used to evaluate contractual specifics as well as strategic and game theoretical notions between decision-making components (agents) of a network. It is basically distribution free since it relies on the analysis of predicting mistakes. We provide examples using information from supply chain agile fashion items.

Barbara Pernici *et al.* [9]Currently, a single organization's production and logistics performance are largely dependent on its internal resources, but they are also increasingly dependent on interactions that take place throughout the so-called supply chain, or interactions between the company and its customers and suppliers. Particularly challenging tasks that use a lot of

resources include manufacturing and logistical coordination amongst supply chain participants. Furthermore, such collaboration necessitates ongoing changes and upgrades. The digital twin's concept is now used in Industry 4.0 to represent, mimic, and evaluate the behaviour of one or more equipment and manufacturing facilities that are owned by an organisation. In order to extend the digital twin concept to supply chains and the dynamics of its actors, this study presents the AgileChains paradigm. This addition has a favourable impact on the internal processes' responsiveness and resilience in the event that the supply chain has to be adjusted. In order to construct service-oriented systems suitable for sharing data in a dynamic and adaptable fashion, we present a unique conceptual framework that blends Service Oriented Architectures (SOA) with Cyber-Physical Systems (CPS). Additionally, we suggest a cutting-edge data management system that can strike a balance between an organization's internal data handling requirements and the need to export data safely and effectively for supply chain use (cf. smart data movement). Finally, we want to develop governance tools that treat agility like a first-class citizen and model and control the supply chain. By focusing in particular on negative, risk-prone events, these tools will enable users to dynamically and predicatively change the involved actors, as well as the nature of the exchanged data and the data exchange policies, in order to reduce risk and achieve the best possible supply chain performance in terms of efficiency and effectiveness.

DISCUSSION

An agile supply chain continuously emphasizes effective procedures and personnel with autonomy. Agile supply networks are quick to adapt to rapid changes in demand and supply. The larger firm benefits from adopting an agile strategy by being able to move swiftly and decisively. This gives it the ability to succeed commercially under challenging conditions. Contrarily, supply networks that lack agility lack quick access to information. Their personnel are forced to "best-guess" how to react to shifting circumstances due to their lack of agility. Making the incorrect choice is now more likely as a result of this. Outperform slower competition by putting an emphasis on agile and lean logistics management. By being able to make quick judgments that are well-informed rather than depending on instinct or insufficient knowledge Today's logistics managers have an increasing number of unexpected circumstances and interruptions to deal with. In a supply chain ecosystem plagued by a worldwide pandemic, bottlenecks, delays, and other adverse conditions are becoming more common. The global on-demand economy under unprecedented strain as emergency safety procedures drove the sector into a spiral and caused severe shortages of everything from computers to toilet paper. The supply chain sector is now facing its largest test in years as a result of this new normal. Although the pandemic was an extreme example of what may go wrong, it also served as a reminder of the need of preparation and decision-making in the event of abrupt interruptions that throw off the intricate contemporary supply chain system's regular operation. We'll look at how firms may utilize a lean, agile, and adaptable strategy to managing supply chains to quickly respond to conditions that change or arise unexpectedly in this article.

Accelerate the Supply Chain: The usage of supply chain visibility tools helps increase supply chain agility. Because they provide the real-time data and insights required for teams to make wise, on-the-spot choices and respond rapidly to changing circumstances, visibility platforms are

excellent agile supply chain solutions. Supply chain visibility has become a given for businesses interested in increasing their agility. Logistics managers want precise data that covers the entirety of their supply chains, from procurement teams to store managers, given the market's quick change and volatility. Before, decision-making for logistics professionals was limited to prior experience and gut feelings. Companies can handle massive volumes of data more quickly than ever now, enabling workers to respond more quickly and effectively than before.

Agile supply chain management executives can quickly identify which of their orders and shipments may be affected in a crisis, as well as which resources are available for recovery and contingency planning. The pandemic's severe supply chain interruptions brought attention to how stagnant most supply systems are. The majority of companies' supply chains collapsed as Asian manufacturing hubs shut down and shipping came to a grinding stop as they frantically scrambled to near-shore or onboard new suppliers. The manner that consumers are affecting supply chain logistics is evolving, even in the absence of catastrophic worldwide pandemics. Because they can provide unmatched consumer choice and quick delivery, businesses like Amazon have developed immensely. Customers now anticipate businesses to meet their needs rather than settling for what has previously been introduced to the market. Companies may be flexible both internally and internationally with the aid of an agile supply chain. Businesses have the internal flexibility to change their supply chain as necessary. Externally, they have a considerable competitive advantage since they can quickly meet client demand and fully exploit brief profit opportunities.

Flexible Supply Chain Techniques: The four main component strategies of the new agile supply chain are virtual integration, process alignment, shared chain accountability, and market sensitivity.

Process Harmonization: Building functional technical relationships with all parties involved in the agile supply chain is what process alignment entails.

Agile supply chains aim to offer value that isn't only cost-based by aligning all stakeholders in single direction rather than engaging in a race to the bottom for the lowest price, which often results in vendors and their suppliers having a confrontational relationship. For instance, manufacturing businesses link suppliers, procurement, and engineers using Jiga's software throughout the component procurement process to maintain alignment and increase visibility. To keep everyone linked, businesses employ procurement technology and a range of S2P systems, including Coupa.

Co-managed inventory, also known as vendor-managed inventory, is one scenario where both the supplier and the vendor are in charge of managing the inventory. Another example is collaborative product design and development, where suppliers and design departments work together at all stages of product development to create products that are as simple to build as feasible. The organisation determines the precise format of the process alignment. The fundamental idea is that when all parties are working together, supply chains are far more effective, nimble, and robu

Online Integration: The free flow of information and transparent, open communication are essential in all agile processes. Regardless of their physical distance from one another, important departments may communicate rapidly thanks to virtual integration. A collaborative planning process that involves all organizational departments that have the potential to meet the demand is used to gather, evaluate, and disseminate demand information as demand from the market or end users grows. Faster information exchanges between all major players are also made possible by virtual integration across a supply chain. By enabling end-to-end insight throughout the supply chain, this quick information flow makes it possible to spot capacity problems or future bottlenecks. In practice, virtual integration makes it possible for a company's supply chain to respond fast to shifting customer needs while also seeing and fixing issues as they arise.

Chain Responsibilities: Process alignment and shared chain responsibility are related concepts, but conceptual rather than technological. Static supply chains are often compartmentalized operations with information and accountability segregated into separate tranches and evaluated using distinct sets of KPIs.

The disadvantages of this are clear. It decreases overall visibility and makes finding the one supply chain link that is "at fault" for every bottleneck and issue. The increased visibility and coordination made possible by process alignment in an agile supply chain enables all participants to share overall responsibility for the effective operation of that supply chain. Internal KPIs are not used to determine operational efficiency; rather, metrics that assess the contribution of each supply chain link to the overall process are used. Whereas process alignment builds the technical framework necessary for every link in the supply chain to pull in the same direction, shared chain responsibility develops a spirit of cooperation, teamwork, and accountability.

Market responsiveness: Agile SCM's ability to respond fast to changes in the market and consumer demand is one of its main advantages. Traditional supply chains are fundamentally backward-looking since the bulk of forecasting is based on historical sales data. Organizations must concentrate on data gathering and analysis in order to fully reap the rewards of an agile supply chain. This will provide them the knowledge necessary to forecast future demand and market trends. Real-time point-of-sale data enables businesses to implement demand-driven decision-making. Companies may recognise how consumer demand is changing and swiftly modify their supply chain to take advantage of it by combining market sensitivity and an agile supply chain.Utilization of Agility in Various Supply Chain Sectors: Generally speaking, agile approaches may be conveniently deployed in five areas of supply chains. These include manufacturing, storage, distribution, production and scheduling.Forecasting: the great majority of businesses concentrate on improving their inventory buying and shipping schedules and future production choices utilizing data from prior cycles. This, however, presupposes that the only market forces going forward will be comparable patterns. Businesses cannot be really flexible and responsive to the market if supply chain decisions are only based on historical data. While planning is an essential component of supply chain management, organizations may also use demand-driven planning by using point of sale data. Companies are able to foresee evident surges in demand while yet being adaptable and well-informed enough to meet shifting client expectations thanks to demand-driven planning and learning from prior cycles.

Planning and production: To prevent overstocking and out-stocking, it is essential to align your production and schedule with your demand-driven sales numbers. Nearly 50% of small firms continue to separate planning and production using various platforms or just distinct Excel spreadsheets. This compartmentalized strategy is incompatible with the virtual interconnection required to run an agile supply chain. Instead, for scheduling and production to be effectively optimized, they must be linked and motivated by sales data. Organizations may increase their reaction times and inventory control by linking these three elements.

Production and Purchasing: First and foremost, it's crucial to develop efficient procurement procedures and engage effectively with your suppliers to make it simple for them to do business with you. Your interactions with suppliers will thus be strengthened, and this will also help to boost visibility and improve agility. More visibility allows you to respond quickly. Many of our clients had the terrible habit of working with suppliers through spreadsheets and emails. This used to damage their relationships with suppliers and reduce visibility, which made it painful.

Another aspect of an agile supply chain is its capacity to swiftly integrate additional producers in order to prevent delays or seize brand-new demand-driven possibilities. Agile supply chains are far more robust because they may swiftly choose new manufacturing partners, allowing them to accommodate abrupt changes in demand or capacity. Using the present pandemic as an example, the firms who were able to switch from conventional foreign manufacturing operations to near-shore new production parameters with a rapid and easy onboarding procedure were those that survived the economic and logistical impact of the epidemic.

Warehousing: Inventory management and static storage may result in large operating expenditures without producing meaningful benefits. Inventory may just sit in warehouses doing nothing for significant portions of the year only to be in place for a certain length of time due to seasonal fluctuations and cyclical sales cycles. Simply enabling businesses to engage with regional manufacturers and logistics providers who can provide the products and services in response to demand will help overcome this issue. Keeping Easter eggs in storage for a whole year. To significantly reduce storage expenses, an agile supply chain enables you to simply have the product made locally right before demand surges that are predicted.

Distribution: Implementing agile methodology enables businesses to find fresh approaches to age-old issues rather than taking on the whole supply chain. Using third-party logistics (3PL) services as a cost-effective substitute for handling logistical tasks like shipping and distribution is one example of this. In recent years, the 3PL logistics sector has become more specialized and competitive. This implies that there is often a specialist 3PL firm that can handle every logistical pain point that your business has. Due to the intense competition in the industry, there are often many 3PL vendors providing affordable solutions, giving businesses the flexibility necessary to maintain an agile supply chain.

Agile Supply Chain is Beneficial: An agile supply chain has a wide variety of advantages, including: Companies with an agile supply chain can respond to shifting client demand thanks to increased flexibility and demand-driven planning. This enables companies to launch items earlier than their rivals and capitalize on limited profit windows. Agile supply chains are more

responsive and adaptable to rapid changes because to the same improved flexibility. An agile supply network can swiftly adjust to and get beyond problems like the loss of a big manufacturing partner or a substantial logistical block when a static supply chain would experience considerable delays. Greater visibility across the whole supply chain is provided by the virtual integration required to run an agile supply chain, enabling businesses to foresee and address pain spots before they become problems. The increased visibility and shared chain accountability enable all supply chain participants to continuously improve efficiency and, when necessary, outsource certain supply chain segments to cost-effective 3PL vendors, resulting in cost savings.

CONCLUSION

All things considered; an agile supply chain is better since it enhances the benefits of a lean supply chain while taking future demand into consideration. It should come as no surprise that many businesses are choosing an agile chain as their preferred approach of inventory management. The newest trend emphasizes adaptation, flexibility, and predicting future consumer patterns via an agile supply chain.

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CHAPTER 18

CROSS-DOCKING ON SUPPLY CHAIN MANAGEMENT IN LOGISTICS

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Abstract:

In essence, cross-docking eliminates the supply chain's "storage" link. In order to continue the voyage, goods are promptly reloaded into outgoing trucks or rail trains after being unloaded from a truck or railroad car and sorted. Consolidating goods for the same destination into fewer transport trucks is simple. Cross-docking is the process of putting products straight onto outgoing trucks after they have been delivered to incoming vehicles.

Keywords: Cross-Docking, Logistics, LTL shipments,Supply Chain Management,Transportation.

INTRODUCTION

Cross-docking is the process of putting products straight onto outgoing trucks after they have been delivered to incoming vehicles. Cross-docking may expedite supply chains and assist companies in bringing products to market more quickly and cost-effectively by reducing or eliminating the need for warehouse storage, space needs, and inventory management. Cross-docking often occurs at a warehouse's designated docking terminal, where incoming cargo is initially processed at a dock and organised according to its eventual destinations. Then, using a forklift, conveyor belt, or other piece of machinery, they are carried to the opposite side of the pier where they are loaded into departing trucks. The ideal items for cross-docking are those that need rapid transportation, like food, are already sorted and labelled for consumers, don't require quality checks, and have consistent demand.

Cross-docking is a method used by certain firms to move completed items from production to an outgoing dock without first keeping them in the warehouse. The accompanying labour expenses for order fulfilment procedures, such as selecting and putting away items, or the usage of fulfilment technologies like pick-to-light, are avoided by not having to store the products. Cross-docking is used by distributors and retailers like Wal-Mart Stores Inc. in other business sectors. Consolidating incoming LTL shipments is where cross-docking may provide some of the biggest savings. By using fewer cars on the outgoing side, LTL shipping businesses may save costs. On the other hand, breaking down big, full shipments in a cross-docking operation may speed up client delivery. However, there are certain drawbacks to cross-docking. One reason is that putting up a cross-docking terminal needs careful planning and design. It also necessitates regular monitoring to verify that everything goes according to plan. Maintaining a high number of carriers is also necessary for cross-docking in order to guarantee that there are sufficient

vehicles, often trucks, to transport items to clients effectively. Since there is limited time and infrastructure for inventory management, it also puts pressure on the logistics provider and its suppliers to maintain a consistent stream of customer-ready items arriving at the ports. Cross-docking is supported by the majority of ERP and supply chain management software suppliers, including software for warehouse management systems and transportation management systems.

Crossdocking is a problem in the supply chain nowadays that calls for cooperation amongst chain participants. Crossdocking is really the mechanism that connects the supply and demand sides of the chain in an era of low inventories, according to Toronto-based management and logistics expert Dave Luton. Market pressures impose growing pressure on the effectiveness of supply chain management (SCM), with demands for higher throughput with fewer stocks, more product lines with lower operating costs, and more value-added services offered to clients. The conventional SCM approach focused on the deployment of inventory buffers at key locations throughout the supply chain to reduce supply and demand unpredictability. Keep in mind that in this illustration, the supply and demand chains are not connected, and the connecting link is provided by inventory buffers. But now, the goal is to align the supply and demand chains to enable flow-through operations made feasible by cross docking. In this approach, cross docking takes the role of inventory buffering as the connecting method since the chains are connected.

It goes without saying that while working with small inventory buffers, supply-chain stability is essential. There is not much room for contingency in the inventory buffers (if the supplier does not deliver the goods on schedule). Sharing information is essential as a result. Fundamental information approach labelling before addressing the function of sophisticated information technology. When stretch-wrapped pallet loads arrive at their final location undamaged, labelling is made easy. Only the pallet has to be recognized, preferably on two faces, since each case in the cargo does not need to be named. On the other hand, breaking down incoming pallet loads will entail marking individual cases or goods and identifying the quantity of pieces going to each consignee. Cross docking becomes more challenging when conditions that are less than ideal are involved. It goes without saying that unpacking, choosing, packing, and labelling take additional time. Some distributors decide not to cross dock deliveries of fewer than full cases.

Supply chains try to please consumers by providing products as a result of the growth of a customer-driven economy. Providing services in the shortest amount of time with the lowest possible material handling costs. Because of mounting pressure. Cross-docking has emerged as a popular strategy for the supply chain's reliance on partners to optimize operations the movement of materials. Instead of handling several distinct deliveries by one driver, they might be combined or re-sorted at a nearby distribution facility, which will increase the efficiency of the driver. Generally speaking, a cargo is It must be transported to the distribution centre after being landed at the port. As soon as the items are unloaded during cross-docking. It will be processed and transported from the arriving trucks to the departing vehicle, where it will be delivered to a certain location. The consumer benefits from this since the supplies are delivered at the appointed time and In terms of the manufacturer, by cutting warehousing costs and time.

Because it decreases inventory, the cross-docking distribution technique is superior than conventional warehousing expenses, storage charges, and handling expenses. Aside from accelerating cash flow and reducing cycle times, it also of a supply chain storage location. Cross-docking enables effective product consolidation, reduces inventory by removing storage, and expedites materials flow, which will lead to more frequent delivery. Reduced material flow due to the fastened flow Inventory deterioration. additionally, it boosts the warehouse's handling capacity while using the least amount of warehouse space. Additionally, benefits including cost savings (warehousing, inventory-holding, handling, and transportation costs enhanced resource use, a closer fit between shipping amounts and actual demand, reduced material costs, labour expenditures, and Cross-docking is an intriguing logistics tactic due to improved distribution operations management [1]. In supply chain and logistics, multi-echelon distribution networks are extremely frequent. Multiple-item factory deliveries to clients are coordinated by organizing shipments in warehouses that maintain long-term inventory. On the other hand, since items are no longer kept at intermediary depots, cross-docking is a logistics method that is distinct from warehousing. Cross-dock facilities, on the other hand, combine inbound goods in accordance with client expectations and promptly transport them to their destinations. In real-world distribution systems, hybrid solutions that include direct shipment, warehousing, and cross-docking are often used. The operational management of hybrid, multi-echelon, multi-item distribution networks is the subject of this study. The VRPCD-SCM issue, also known as the N-echelon vehicle routing problem with cross-docking, aims to meet client expectations at the lowest possible total transportation cost. On the basis of a mixed-integer linear mathematical formulation, a monolithic optimization framework for the VRPCD-SCM is proposed. Several issue situations' computational findings are provided [2].

This article's goal is to look into the lean warehouse techniques that Brazilian warehouses employ the most. Three stages of the research process were carried out: a survey of the literature, many case studies, and an examination of the adoption of lean warehouse techniques by an engineering committee. Consequently, both qualitative and quantitative methods were used. The research also has an exploratory and descriptive aspect and is applied in nature. Findings: The results revealed that the practices with the highest adoption rates are those that do not need financial expenditures in technology, independent of the kind of criteria utilized. However, the absence of techniques like RFID and Cross Docking systems from any of the activities suggests that there is room for improvement. This article's main contribution is to start a discussion about the management and productivity of Brazilian warehouses, a topic that has received relatively little attention from the academic community despite the significance of the logistical situation for Brazil as a developing nation and a leader in Latin America that actively participates in a number of global supply chains.The spread of e-commerce, the COVID-19 epidemic, and a number of other issues are posing challenges to society that are forcing changes in the supply chains of businesses, such as cutting product delivery times and paying attention to customer welfare and the environment, to name a few. Cross-docking is one logistical option that may be effectively managed to enhance the performance of the supply chain. Here, we concentrate on how truck scheduling and route selection may be integrated; doing so can assist structure distribution centres and customer services while also drastically lowering expenses. This article examines the integrated issue known as Open Vehicle Routing Problem With Cross-Docking,

which involves the scheduling of trucks at a cross-docking facility with several docks (OVRPCD). This strategy tries to reduce fines brought on by customer service delays. To address tiny cases as efficiently as possible, a mixed-integer linear programming paradigm is first suggested. Then, two heuristics are suggested to help with the integrated solution of the two issues. These heuristics, which each concentrate on one of the issues, are the Vehicle Routing Cross-Docking Heuristic (VRCDH) and the Cross-Docking Vehicle Routing Heuristic (CDVRH). To enhance the solutions discovered, we additionally provide a Prioritization Lagrangian Heuristic (PLH) based on a model decomposition. A constructive version (HC) utilising the swap heuristic and a version using the Variable Neighborhood Search (VNS) metaheuristic framework are the two search methodologies that are taken into account while comparing these three heuristics. The heuristics work better than the original ones while using VNS. The three heuristics still have the same relationship, with the PLH outperforming the VRCDH and the latter outperforming the CDVRH. In order to approximate our issue to a real cross-docking centre, we offer a polynomial-time framework called Robust Dynamic Prioritization Lagrangian Heuristic (RDPLH), which extends PLH and takes into account the uncertainty in truck release dates and trip durations. We claim that this strategy may be used in actual cross-docking centres due to the framework's simplicity and the effectiveness of the findings (CDCs).

A number of issues that society is dealing with, such as the increase in urbanisation, the growth of e-commerce, the COVID-19 pandemic, and many others, are causing changes in the supply chains of businesses, such as reducing product delivery times and paying attention to consumer welfare and the environment, to name a few. The performance of the supply chain may be enhanced by the effective handling of logistical options like cross-docking. Here, we emphasise the integration of truck scheduling and routing choices, which may assist structure distribution centres and customer services while also drastically lowering costs[3]–[6]. The integrated issue known as Open Vehicle Routing Problem With Cross-Docking, which involves the scheduling of trucks at a cross-docking facility with several docks, is examined in this article (OVRPCD). With this strategy, we want to lessen the consequences of customer service delays. In order to best address tiny cases, a mixed-integer linear programming model is first presented. The following two heuristics are suggested to aid in the combined resolution of the two issues. The Cross-Docking Vehicle Routing Heuristic (CDVRH) and the Vehicle Routing Cross-Docking Heuristic (VRCDH), each of which focuses on a different issue, are these heuristics. In order to enhance the results, we additionally recommend a Prioritization Lagrangian Heuristic (PLH) based on a model decomposition. In order to compare these three heuristics, two search methodologies were used: a constructive version (HC) utilising the swap heuristic and a version using the Variable Neighborhood Search (VNS) metaheuristic framework. The heuristics perform better than their earlier iterations with VNS enhancements. The PLH heuristic outperforms the VRCDH heuristic, while the latter outperforms the CDVRH heuristic, but the relationship between the three heuristics remains the same. Then, to approximate our issue to a real cross-docking centre, we provide a polynomial-time framework called Robust Dynamic Prioritization Lagrangian Heuristic (RDPLH). This framework enhances PLH by taking into account the uncertainty in truck release dates and trip timings. We claim that this strategy may be implemented in actual cross-docking centres due to the framework's simplicity and the findings' high quality (CDCs).

Saeid Rezaei and Amirsaman Kheirkhah [7]Companies are always seeking for innovative strategies to improve their operations in order to develop the competitive priorities of today. The requirement for corporate sustainability in logistics networks is seen as necessitating integrated forward/reverse supply chain management. The recycling of discarded goods is also a prevalent activity as a result of rising environmental and economic concerns. Cross-docking has lately made headlines since it has been acknowledged as a significant area for performance improvement in forward logistics. However, there are few ways that simultaneously take into account the forward and reverse aspects of this strategy. This study demonstrates the effective implementation of cross-docking in a forward/reverse structure and, in this respect, presents an integrated multi-product supply chain network to fill these gaps. We initially offer a mixed-integer linear programming (MILP) approach to analyse the issue and reduce overall expenditures. Second, we use the general algebraic modelling system (GAMS) software to resolve the resulting model. Additionally, in order to define two theories, the performance of the model is assessed by contrasting the use of forward/reverse cross-docking with that of the traditional technique (no use of this strategy) in the network configuration. The important results of using forward/reverse cross-docking in the network are finally explored. The model improves the effectiveness of the integrated forward/reverse logistics when taking the aforementioned criteria into account.

Mariana Cóccola *et al.* [8]Managing and optimising the supply chain attempts to cut costs and inventory. Utilizing cross-docking to combine shipments from several suppliers is one technique to improve the efficiency of the supply chain. Cross-docking is a method of warehousing used in logistics that involves transporting products from suppliers to clients through a cross-dock facility. This tactic's usage has to be carefully considered since occasionally it makes more sense to transfer transportation requests straight from the source to the destination. Here is a discussion of a practical issue looking at the convenience of direct delivery by eliminating certain cross-docking transfers. Also discussed is a productive process for locating (near) optimum solutions. The approach is based on the integration of a branch-and-price tree with column generation. By addressing the column generation sub-problems without necessarily taking into account all unexplored nodes in the search-tree, the method yields (near) optimal solutions. Finally, we provide computational findings from a variety of test issues and four different arrangements of the discussed case study.

Wen Shi *et al.* [9]To address a multi-response optimization challenge inherent in logistics management, we provide a framework for a solution based on discrete-event simulation and improved resilient design method. The goal is to create a cross-docking distribution centre with a resilient layout that will deliver a consistent supply of components to assembly facilities downstream while being insensitive to supply-chain disruptions. In the suggested method, a simulation model is first built using factorial design and central composite design (CCD), and the models that best capture the link between simulation responses and system elements are then identified. To determine the factor values that would optimize system potential, we use the response surface methodology (RSM). We suggest a robust design strategy that incorporates Latin hypercube sampling and takes noise considerations (disturbances) into account to make the system resistant to elements that might negatively influence performance. We modify Derringer-

desirability Suich's function to find the ideal operating circumstances in order to accommodate numerous performance measurements and guarantee that all answers remain within the intended objectives. Finally, we compare the outcomes of the proposed robust architecture with the traditional RSM using bootstrapping. The suggested model aids the investigated auto parts supply chain in gaining understanding of the dynamics of the system and locating the optimal operating conditions that minimize the effects of supply uncertainty on the effectiveness of the cross-docking facility.

DISCUSSION

A sophisticated supply chain method known as "retail cross-docking" creates a virtual order management and operational execution system between a retail chain's geographically scattered outlets and its many suppliers. To ensure the accurate and quick flow-through of store ordered products directly from the suppliers' warehouses to the cross-docking facilities and then to the retail stores, it is especially important to install supply chain collaborative/control scheduling system and sophisticated automatic material handling equipment for the carton or item-based orders.

In actuality, the cross-docking setup of a retail chain can produce competitive advantages and value for the retail chain and its suppliers through supply chain inventory reduction, quick inventory turnover at stores and supplier warehouses, shortened order cycle times, increased truck load factors and fleet utilization, streamlined information flow and improved supply chain collaboration, and so forth. A dry goods distribution center typically services 80 to 150 shops in the supermarket sector of Japan using cutting-edge cross-docking operations and sorting technology. A distribution center does not store items; rather, it acts as a flow-through facility for commodities sold in retail stores. In contrast, a dry goods distribution center in Taiwan would maintain stocks of various items for 2 to 6 weeks in order to meet the demands of the chain's 100 to 200 designated outlets.The key planning and modelling issues for the cross-docking operation of a large supermarket retail chain in Taiwan, with a focus on the practical or heuristics approach rather than the theoretical or optimization approach, using the knowledge accumulated from participating in the first dry goods cross docking development and transformation of a large supermarket chain.

Services for cross-docking: In a logistics process called cross-docking, goods from a supplier or manufacturing facility are delivered straight to an outgoing carrier, such a client or retail chain. In essence, it eliminates the supply chain's storage link. In a distribution docking terminal with dock doors on both sides, cross-docking takes place (inbound and outbound). This procedure keeps supply networks operating efficiently. Cross-docking facilities are more like a "sorting centre" than a typical distribution centre since there isn't much room for storing items there.

Compared to a distribution centre, cross-docking warehouses have far less storage capacity. Shipments arriving first proceed to a receiving dock. The goods are then transported straight to their final locations using forklifts, conveyor belts, pallet trucks, or other equipment. Prior to

moving on to outbound shipment, they are sorted and consolidated. The average time that the products are at a docking facility is under 24 hours.

Use of cross-docking services: A business might enhance inventory turns and save material handling and distribution expenses by switching from conventional distribution centres to cross-docking facilities. By removing the need for warehouse space and manpower, effective cross-docking may also save expenses. Costs are reduced since less packing and storage space is required. This approach seems to be a supply chain update that works everywhere. However, this approach has a considerable positive impact on several businesses. These sectors comprise:

1. Foods, drinks, and items that spoil quickly
2. Components from outside suppliers and raw materials
3. Pre-packaged and categorised goods, packages
4. Sectors that make advantage of cross-docking

Cross-docking has several advantages for supply chains throughout the nation. Cross-docking, however, gives certain sectors a greater competitive edge than others. For instance: Automotive, Chemicals, Purchased Goods, Food and Drink

Advantages and hazards come with cross-docking services

Not all storage requirements will be met by the cross-docking operation. Understanding the advantages and hazards associated with it is crucial.

The advantages: Cross-docking has several advantages, including the following: reduction in storage space. Cross-docking frees up core storage space even if a place in the facility must be booked in order to house the items. As a consequence, inventory cost reductions are also a benefit of the protected area.

By expediting the distribution of products, it reduces delivery times and creates a supply chain that is more adaptable. This raises client satisfaction as a consequence. Unloading, quality assurance, order conditioning, and product shipping are all still carried out, although there are much fewer processes and loads handled. Less danger of product damage exists thanks to the removal of the intermediate operation responsibilities. Because it saves time, effective cross-docking raises the overall profitability of the facilities that use it.

The dangers: Since nothing is flawless, everything that has advantages typically also has drawbacks.

Cross-docking implementation may need a full layout of your warehouse to provide room for a conditioning area to aid with cross-docking duties. As a consequence, this tactic may be expensive.

The whole supply chain must be successfully integrated, as well as information systems like fleet and warehouse management software.

For coordination and planning, a lot of time is needed.

Using cross-docking: Continuous cross-docking, consolidation arrangements, and deconsolidation arrangements are the three main cross-docking techniques.

Perpetual cross-docking: Continuous cross-docking is said to be the easiest and quickest approach. Products and materials are continually moved to a central location during continuous cross-docking. These goods are moved right away from an incoming truck to an exiting truck. There are few waits using this strategy. However, there will be a waiting period for trucks that arrive at the port at various times.

Arrangements for consolidation: In the cross-docking facility, numerous smaller goods or freight loads are combined into one large shipment under the consolidation arrangement approach. In this manner, inbound freight and items kept at the terminal are merged to create entire truckload shipments. It is advantageous to employ this strategy since shipping individual packages from the cross-docking facility is not always profitable. Until the truckload is full, all agreed consolidation loads must be temporarily kept in a warehouse. A cargo can only be transported once it is completely filled. Despite the delay in delivery, this strategy has helped businesses save shipping expenses.

Arrangements for deconsolidation: The antithesis of a consolidation arrangement, which divides big product loads into multiple smaller loads for convenient transportation, is a deconsolidation arrangement. Usually, these little shipments are delivered right to the consumer. Direct-to-consumer fulfilment has typically employed this method.

Using cross-docking services and a 3PL: Cross-docking is used by trucking businesses because it reduces transportation costs since vehicles have bigger loads and precise destinations for each cargo. This shipping approach shortens the total amount of time needed to reach each consumer and enables a shipper to respond swiftly to new selling channels and market circumstances.

Companies must establish effective monitoring and compliance to achieve acceptable performance, despite the fact that this approach offers considerable financial and operational benefits. We provide data-driven supply chain strategies via a partnership with PLS Logistics Services to assist assure control and visibility of shipments from supplier to end customer.

Applications and Benefits of Cross-Docking: Due to intense competition and the ease of access to several markets, the distribution process which accounts for 30% of the cost of a product's sale increases overhead costs across the whole supply chain and has a detrimental influence on suppliers and the production process. Therefore, it is necessary to lower distribution costs and boost distribution effectiveness. Through the consolidation of shipments from various origins and the subsequent delivery of the goods to a cross-dock location where the shipments are unloaded and immediately recombined with loads having the same destination, a strong cross-docking strategy can overcome the high costs of storage and handling. By combining different-sized shipments going to the same location, cross-docking may improve the use of truck capacity and complete truckloads. Other benefits of a cross-docking strategy include lower costs for warehousing, inventory-holding, handling, labor, and transportation shorter lead times for

deliveries from suppliers to customer's consolidation of shipments, better resource utilization, lower risks of product damage and obsolescence, increased control over delivery schedules higher levels of service and a reduction in the burden on the environment.

Cross-docking has been used in several documented applications, according to the literature. Cross-docking of food delivery, for instance, boosts productivity and results in considerable cost savings in the food sector, there are other retailers that have successfully used cross-docking. The first company to suggest this tactic was Wal-Mart, which saw an increase in earnings and market share. Due to deploying cross-docking to 85% of its inventory, which also resulted in a 2-3% cost cut, Wal-Mart was the most profitable retailer in the world in 1992. In order to control time to market and pharmaceutical waste, the cross-docking strategy is also used in the pharmaceutical supply chain. This is done by optimizing scheduling, the reaction time in the medicine room, and removing pointless tasks. Cross-docking is effective for transferring several objects quickly. Using a cross-docking method at the fulfilment centers for online retailing to shorten delivery times, lower shelving and handling costs, and in certain situations, lower shipping costs [10]–[12].

Recent efforts to increase the effectiveness of supply networks have focused on expenses associated with inventory, paying particular emphasis to how long inventory remains in the supply chain. Moving items through the supply chain as soon as possible is often a key administrative goal because of the amount of cash that is locked up in inventory. Cross-docking is one tactic that has been developed to shorten the amount of time inventory spends in the supply chain. By receiving items at an incoming dock and instantly relocating them "cross dock" for outbound shipping to consumers, cross-docking quickens inventory movement. For instance, cross-docking at Wal-Mart is a well-documented factor in the retailer's exceptional customer service.

Cross-docking may be used in a variety of ways, and each way has its own needs and effects on suppliers, distributors, and clients. For instance, there are hub-and-spoke arrangements, in which materials are transported to a single location before being sorted for delivery to a number of locations; consolidation arrangements, in which a number of smaller shipments are combined into one larger shipment for transportation economy; and deconsolidation arrangements, in which large shipments are divided into smaller lots for delivery ease, frequently involving a third party. We concentrate on this last use of cross-docking in this work, more precisely the scenario where truck load (TL) cargoes containing numerous orders are divided into smaller amounts for delivery to individual client locations through less-than-truckload (LTL) carriers.

Because it has the ability to do away with picking and storing, two of the most costly tasks in conventional storage, cross-docking may be very valuable. Reducing product storage may boost inventory rotations, which can lower carrying costs for inventories and quicken the flow of goods to customers. Less inventory may also imply less need for handling and storage space, equipment, and manpower, as well as a lower chance of product damage and obsolescence. While cross-docking is a desirable choice for supply chain management due to its advantages, the circumstances in which it is most advantageous are not always obvious. To fully profit from cross-docking, stress that appropriate planning and management tools are required. Given the

various shipping options, a number of factors must be reviewed in order to decide whether cross-docking makes sense, and models used to support this choice must appropriately depict the associated costs. In this study, we create a model that gives us insights into the circumstances in which cross-docking benefits supply chain managers the greatest.

CONCLUSION

Cross docking is a shipping technique that moves products from one mode of transportation to another so they may go straight from the point of origin to the destination. Cross docking is frequently utilized in freight transportation because, among other advantages, it lowers prices and frees up storage space.

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CHAPTER 19

DESIGN OF MANUFACTURING IN SUPPLY CHAIN PLANNING

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Abstract:

Design for Manufacturing (DFM) is the process of creating goods, parts, or components that are simple to manufacture with the aim of producing them more affordably. This is accomplished through streamlining, improving, and perfecting the product design. The method by which a business organizes and controls its supply chain in order to find the ideal balance between inventory, transportation, and production costs is known as supply chain design. Five fundamental concepts underpin Design for Manufacturing, all of which must be carefully taken into account throughout the project's design process. Process, design, materials, environment, and compliance are some of these guiding concepts.

Keywords: Manufacturing, Design for Manufacturing, Supply Chain Planning, System, Transforming.

INTRODUCTION

The process of transforming a raw material into a completed, physical product is known as manufacturing. Making a process more effective as it transforms some resources into other resources, often with the intention of being sold to a client, is what manufacturing includes. A supply chain is defined by the movement of goods and information among and between commercial organizations, such as suppliers, manufacturers, and clients. Meeting customer demand is supply chain management's ultimate objective efficiently. Making the right product in the right quantity, for the right client, at the right time is the goal for a manufacturing firm. Supply networks must be properly planned for this. A thorough examination of current models and techniques for supply chain design and analysis. The structure of a supply chain is determined by its design, which centers on where decision points are located and the design's goals. A smart design should priorities the chain's optimization above the optimization of a specific component. The bulk of supply chain design papers that have been published have emphasized important strategic problems. Instead of particular tools for plant managers, the outcomes are often general advice for corporate leaders. The strategy presented in this study may be used by a plant management to choose suppliers according to the kind of outsourced components. Supply chain operations reference (SCOR) model level I performance measures are used to guide decisions. The decision-making process is carried out using the analytical hierarchy process (AHP). The next section explains the rationale for using AHP before outlining the approach.Design for Manufacturing (DFM) is the process of creating goods, parts, or components that are simple to manufacture with the aim of producing them more affordably. This is accomplished through streamlining, improving, and perfecting the product design. Sometimes DFM and the abbreviation DFMA (Design for Manufacturing and Assembly) are

used interchangeably. During a DFM, five principles are explored. As follows: Process \design \material \environment \compliance/Testing

DFM should ideally take place early in the design phase, long before tooling has started. All parties involved in the project, including engineers, designers, contract manufacturers, mould builders, and material suppliers, must be included in a successfully completed DFM. This "cross-functional" DFM's goal is to question the design and examine it from all angles, including the component, sub-system, system, and holistic levels, to make sure it is cost-effective and optimal.

The impact of an early DFM is well shown in the following graph. Changes grow more costly as the design moves through the product life cycle and are also more challenging to accomplish. Early DFM enables rapid and inexpensive site execution of design modifications.

Even though questioning the initial design is an essential component of a full DFM, bringing stakeholders together early in the design process is simpler if you're creating a new product. By copying an earlier design, errors in a design are all too often replicated. Examine each component of your design.

DFM Principles:

1. Process: The item or product must be manufactured using the appropriate manufacturing procedure. To create a low-volume item that might have been produced using a lower-capitalized technique, like thermoforming, you wouldn't want to utilise a very capital-intensive process like injection moulding, which requires the construction of tools and dies. That is a classic example of overkill using a tank to destroy an anthill. Let's hear from Jeff on choosing the best manufacturing process: The amount of pieces being manufactured, the material being utilised, the intricacy of the surfaces, the needed tolerances, and if additional processes were necessary were all factors taken into account by the DFM.

2. Designing: Design is important. The item or product's actual design has to follow acceptable manufacturing practises for the manufacturing technique you've selected. Here is Jeff discussing the mouse's design. The following guidelines would be applicable, for instance, in the case of plastic injection moulding: Wall thickness that is constant, allowing for rapid and constant component cooling

Suitable draught (1 - 2 degree is usually acceptable)

For each 0.001" of texture depth on the side walls, the texture is required to be one degree.

As a general rule, ribs equal 60% of the nominal wall.

Simple changes between thick and thin characteristics

Wall thickness shouldn't be too thin since this raises injection pressure.

No side actions or undercuts; all features are "in line of pull/mold opening."

Consult the trade association for your manufacturing method to determine what is appropriate for that process, and specify the loosest tolerances that enable a satisfactory result.

Talk about the design with your contract manufacturer so they can make sure it complies with acceptable manufacturing practices for the chosen technique.

Material: It's critical to choose the appropriate material for your component or product. In this video, Jeff discusses some of the factors that influence that choice:

Some material characteristics to take into account during DFM are:

Electrical properties: Does the substance need to be dielectric that is, an insulator rather than a conductor in order to function. Once again, be sure to talk about the material with your contract manufacturer. They could have access to materials that are already in their portfolio and be able to help you negotiate a reduced material price.Environment: Your component/product must be built to survive the environment to which it will be exposed. If the component cannot operate correctly under typical operating circumstances, no amount of form will matter.

Compliance/Testing: Standards for product safety and quality must be met by all goods. These standards might be third-party standards, internal standards set by the firm, or standards set by the industry.

Factors Impacting DFM: DFM seeks to lower production costs without sacrificing performance. Here are five elements that may impact design for manufacturing and design for assembly in addition to the DFM principles:

1. Reduce the Part Count: The simplest approach to save costs is to lower the number of components in a product since you are decreasing the quantity of material needed, the amount of engineering, manufacturing, labor, and even shipping expenses.

2. Standardize Materials and Parts: Customization and personalization cost money and take time. Utilizing high-quality, standardized components helps accelerate manufacturing since they are often on hand and their uniformity can be more reliably guaranteed. Material is determined by the product's function and intended usage. Consider:

3. Create modular assemblies: If you use non-customized modules or modular assemblies in your design, you may change the product's functionality without affecting how it works as a whole. An easy illustration is a basic vehicle that enables you to add additional by installing a modular upgrade.

4. Create Joining: That Are Efficient: for alternatives to screws, fasteners, and adhesives to link pieces. Here are some suggestions if you have to utilize fasteners: Reduce the number, size, and variety of fasteners as much as possible. Utilize common fasteners as much as you can. For optimum positioning, use self-tapping and chamfered screws. Avoid using separate washers, tapped holes, round and flathead screws, separate washers, and screws that are excessively long or short.

5. Reduce Parts' Rotation during Assembly & Machining: The design of parts should minimize the amount of manual labour required during manufacture and assembly. Reduce the number of manufacturing operations and processes, point number six. The more variables there are for mistake, the more difficult the manufacturing process is. Keep in mind what Jeff said: Every process has capabilities and limits. Include just those processes that are necessary for the design to work.

6. Describe "acceptable" surface finishes: Choose a surface finish that serves a purpose rather than being spectacular, unless it must be suitable for a trade display

With the use of newly created information technologies, such as cyber-physical systems, the Internet of things, big data analytics, and cloud computing, Industry 4.0 aspires to automate conventional manufacturing and industrial processes. Industry 4.0 implementation in manufacturing results in the digitalization of all manufacturing enterprises, including enterprise resource planning, supply chain management, and computer assisted design and manufacture (SCM). In a dynamic, dispersed, and decentralised corporate world, digitising supply chains presents both obstacles and opportunities. Industry 4.0 supply chain complexity and dynamics are explored, the effectiveness of a supply chain is assessed in terms of costs and service quality, and supply chain management is posed as an optimization issue for improved standards of service quality, efficiency, and timeliness. The difficulties of creating digital tools for data collection, fusion, and support for data-driven decision-making are thoroughly examined. Using information from a list of Chinese automakers, viable solutions to these problems are suggested, and the effects on supply chain management are evaluated. The digitization of supply chains will be significantly and favourably impacted by the suggested solutions, it has been determined [1].

This study discusses the supply planning issue in relation to the Manufacturing Supply Chains (MSC) configuration challenge. We provide a method for the strategic management of the chain that addresses supply planning and enhances the MSC's agility in terms of capacity to reconfigure to meet performance, supposing that the manufacturing system is built of several phases. More specifically, we improve a prior design technique used by some of the authors that uses integer linear programming and digraph modelling to create the MSC.

The original method manages the delivery of replacement parts while preventing stock outs and disruptions to the supply chain. In this novel formulation, we incorporate supplier capacity restrictions to account for the amount of requests and maximum production capabilities with single/multiple sourcing. An Italian manufacturing company's ideal MSC arrangement is given in a case study. The findings collected demonstrate that the design technique offers managers important solutions to problems relating to the strategic configuration and agility of the supply chain, for example, selecting the ideal location for distributors and retailers for increased MSC flexibility and performance[2]–[5].

Big data is crucial to the supply chain because it offers analytical capabilities for corporate information and decision-making. Big data and supply chain 4.0 are essential for businesses to manage volatile, dynamic, and international value networks. This study looks at how "big data analytics" may help bridge the gap between Supply Chain 4.0 company performance and nine performance indicators. Design/methodology/approach: The data are analysed using a two-stage hybrid model that combines statistical analysis and artificial neural network analysis. For the research, information from 321 replies from 40 Indian manufacturing companies was obtained. Findings: According to statistical analysis, organisational and top management performance factors, sustainable sourcing and procurement, environmental factors, information and product delivery, operational factors, technical and knowledge factors, and collaborative planning have a big impact on the adoption of big data. The findings of the artificial neural network model that was used to forecast the adoption of big data also indicated that "information and product delivery" and "sustainable procurement and sourcing" were the two most important predictors. Research constraints and consequences Big data's mediating significance in Supply Chain 4.0 in industrial organisations of poor nations is confirmed by this research. This research provides guidance for developing organisational big data analytics vision and management policies. Originality/Value: The effects of big data on Supply Chain 4.0 are for the first time examined in

the context of Indian manufacturing companies. The suggested hybrid model aims to assess big data analytics' mediating function in order to improve Supply Chain 4.0 company performance.

Designing sustainable manufacturing firms has been a crucial topic in recent years because of the strict awareness toward the preservation and resuscitation of natural resources as well as the possible economic rewards. Coordinating the operations within the production systems with the full closed-loop supply chain is made more difficult as a result. This study presents a mixed-integer mathematical model for creating a closed-loop supply chain hybrid manufacturing and remanufacturing system. It is noteworthy that the tactical planning of a closed-loop supply chain is coordinated with the operational planning of a cellular hybrid manufacturing-remanufacturing system. Alternative process routings and contingency process routings are taken into account to increase the cellular hybrid manufacturing-remanufacturing system's flexibility and dependability. To the best of our knowledge, the mathematical model presented in this study is the first integrated model for the design of hybrid cellular manufacturing systems that takes dependability of the manufacturing system, major process routings, and contingency process routings into account[6]–[8].The multifloor manufacturing (MFM) cluster found in cities is the subject of this study's integrated sustainable waste management (ISWM) analysis. Municipal production waste (MPW) generated as a result of manufacturing activity in urban residential areas is a severe issue. Designing smart supply chain (SSC) scenarios for the transportation of MPW from a city MFM cluster under uncertainty is the main objective of this work. Based on an investigation of a city MFM cluster's limited production capacity using the material flow analysis (MFA) approach, this research proposes a novel model of the finite MPW generating capacity. With the help of the suggested model, we can estimate the quantity of transport fleet units required to execute different MPW supply chain (SC) scenarios. The implementation of SSC and SSC management (SSCM) technologies is suggested in order to choose the ideal scenario for MPW shipping in real time. We are given the opportunity to assess the effectiveness of deploying automobiles for cluster MPW transportation using SSCM performance metrics. For several approaches to handle city MFM buildings with trucks, the numerical values of the SSCM performance indicators are produced. The SSCs of MPW use these assessments as the foundation for their planning and decision-making.Gangaraju Vanteddu and Gillian M. Nicholls [9] Even while a dimension stone supply chain resembles a standard manufacturing or processing sector supply chain in many ways, it also has certain distinctive features of its own. These features include the great number of dimension stone varieties spread over vast geographic areas, the variety in raw dimension stone sizes owing to the differing grade of rock deposits, and the variation in the physical attributes of various types. Varied types of dimension stones have different chemical compositions, hardnesses, textures, fractures, and cleavages. These distinctive qualities lead to multi-dimensional complexity in modelling various processes, from the level of rock extraction to the stage of the retail shop. A dimension stone supply chain is examined in this study from both strategic and tactical angles to solve the problems of supply chain network architecture and production planning. This study highlights the distinctive qualities of a dimension stone supply chain that set it apart from supply networks for other mineral commodities. To assist in the design of the supply chain network, a formulation based on Mixed Integer Linear Programming (MILP) is proposed to model the capacitated facility location problem, and a model based on linear programming is proposed to address supply chain process issues related to material transformation to aid in medium-term tactical planning. Additionally offered are thorough numerical evaluations that serve to clarify the suggested mathematical models.

The goal of this study is to examine how supply chain risk management and sustainability might be combined in recent years. Although these research have provided important new insights into this problem, it is still unclear how sustainability-related problems manifest as supply chain management hazards. Design/methodology/approach: The purpose of the study is to provide a thorough methodology for assessing the sustainability risk in the supply chain management system. To achieve this, an unique technique is provided to identify, rank, and assess the sustainability risk factors in supply chain management using the double normalization-based multiple aggregation (DNMA) approach in an intuitionistic fuzzy (IF) environment. Findings: This research used interviews and a literature analysis to perform a survey in order to give complete sustainability risk indicators. This study identified 36 sustainability risk factors in the supply chain management of the manufacturing companies under five different risk categories, including sustainable operational risk factors, economic risk factors, environmental risk factors, social risk factors, and sustainable distribution and recycling risk factors. According to the findings of this study, environmental accidents, production capacity risk, product design risk, and unethical recruiting practises were all significant sustainability risks in the supply chain management of manufacturing enterprises. The extended method was successful and efficient in analysing the sustainability risk elements in the supply chain management of the manufacturing enterprises, according to the study's findings. Originality/value: On the basis of the normalising procedures, three aggregation strategies are explored. In the context of intuitionistic fuzzy sets, a DNMA approach is presented (IFSs). To put out a comprehensive method for locating and categorising sustainability risk factors (ESFs) in supply chain management. The authors use a method for assessing the sustainability risk factor's level of relevance in supply chain management in order to rank it.

DISCUSSION

The process of envisioning, developing, and refining products that answer particular market demands or solve issues for customers is known as product design. Craftspeople made goods mostly by hand before the mass-production age of manufacturing. As a result, there were more expensive and scarcer things for sale. Later, the industrialization of manufacturing made it possible for companies to make goods in large quantities at cheap cost. Manufacturing companies engaged the aid of industrial designers to produce items that were not only practical but also visually beautiful in order to help sell their goods to the millions of people who could now buy them. Designing a product is important for the business since it becomes a selling point, or what we refer to as a WOW moment. Companies are increasingly concentrating on it as a profit generator by decreasing costs in the beginning stages despite it being a selling feature in the company (creating prototype).

Product development and business planning: Price, quality, and product design all factor into customers' purchasing choices. As a consequence, product design strategy is a crucial component of a company's business strategy since it establishes the features and functionality of new products and services that have the potential to significantly increase sales income. One of the main objectives of company strategy is to meet client demand for novel and diverse items via product design. According to a poll, the product design department often receives more than 10% of a company's funding. Companies now turn to product design in addition to cost-cutting measures to get a competitive advantage in the market.

Product development and supply chain administration: The design of a product affect a company's supply chain is a crucial topic that comes to mind. Buying raw materials is the solution to this. Let's imagine that product designers or design engineers desire the best component in the end integrated product in order to win over customers. Designers will concentrate more on reaching to the point of incorporating the best features into a product. This in turn resulted in higher procurement costs since high product quality and durability tend to be expensive, and these materials are often over engineered.

Here, the supply chain manager and the designers should get down at a table and settle on "Just Enough Technology" for the goods that are produced in-house. With the assistance of procurement managers or supply chain managers, this will help to generate new ideas for product design procedures and will undoubtedly aid in modifying product cost. Purchasing materials from remote or specialized suppliers is a crucial consideration that should be made while keeping in mind the viewpoint of the product's engineers and designers.

Lack of communication between supply chain experts and product designers/engineers has another unnoticeable effect. As was already mentioned, designers priorities using the best components for products, but this would undoubtedly have a negative effect because supply chain and procurement managers priorities saving money by purchasing goods at the lowest prices possible, which occasionally leads to low-quality finished products. Additionally, purchasing goods from several places might often result in higher shipping costs.

Implementing Diamond Suppliers in the creating and supply chain system is a fantastic remedy for this. Who are the sources of diamonds? These vendors provide services for product creation and engineering to create highly integrated modules in addition to providing components for the production of a specific products. They will provide an end-to-end solution and assist in lowering the cost of SCM. When Sony introduced the Xperia device to the market, they used this strategy. With this product, Supply Chain Management's three primary functions might be affected.

a) Standardization: Businesses may standardize product parts or production procedures. Common components are employed in several distinct goods when a product is standardized. Costs are decreased and the need for large component inventories is decreased. For all types of goods, the production process is as closely standardized as is practical in process standardization. Late in the manufacturing process is when products are differentiated and personalized. Redesigning items so they may be altered later in the manufacturing process is often part of process standardization.

b) Packaging: How a product is packaged entirely depends on its design and the technologies that should be used in the warehouse to speed up the packing process for each individual product. Compactly packaged goods are plainly less expensive to transport. Flat-pack furniture is a typical illustration of this product design application. Additionally, based on the design and how it should be packaged, it will also specify how much packing material has to be ordered.

c) Consolidation: This generally takes place during delivery, when the price is greatly influenced by the weight and size of the package. Therefore, while creating new goods, designers should pay attention to these factors as well and create items that are easy to move.

Consumerism is prevalent in our culture. Now that our society has practically gone global, product design is more crucial than ever. While we still have a fundamental need for stuff, our desires are very different. In order to take advantage of our rampant consumerism, great product design makes use of both our necessities and our wants. Where there is consumerism, an efficient supply chain is required. The sole factor that distinguishes one brand of a certain commodity from another on the market among the sea of identical goods is its design. Although things have always had a purpose, they increasingly contain significance. Good product design should be able to successfully convey this message to the user. In the future, supply chain specialists should, in my opinion, not only concentrate on finding the best deals on commodities, but also study the product's design with the assistance of designers in order to find cost savings right away.

Any business's ultimate objective is a happy consumer. The fundamental task of supply chain management is to find, acquire, and convey the inputs required to achieve this. Supply chain design, especially in the industrial sector, necessitates a strong emphasis on physical goods and a larger supplier base. Service businesses, on the other hand, often operate with a much narrower set of suppliers and generally have minimal need for physical inputs other than office supplies.

Both the industrial and service sectors need a variety of inputs to finish the processing required to fulfil their commitment to the end client. The largest input in both the industrial and service sectors is labour. Companies in both sectors also need input from suppliers of all kinds, including providers of products, raw materials, packaging, etc. According to the lifecycle management business Upchain, content that has been purchased is used to create around 70% of goods. Finally, both sectors of the economy need capital expenditures for the tools that enable their workers to accomplish their jobs. According to the strategic marketing firm Griffin and Co., the main distinction is that the majority of labour costs in the manufacturing sector go toward acquiring, moving, and manipulating physical materials, whereas almost all labour costs in the service sector go toward modifying information and cultivating relationships. This distinction explains why manufacturing businesses often spend substantially more in machinery and equipment.

Chain Logistics in Supply: Traditional industrial supply chain management places a strong emphasis on logistics when it comes to transporting tangible goods from one place to another. The cost of the product may be significantly influenced by the size, weight, and distance between the supplier and the production site. These criteria are meaningless in-service firms, especially in the financial industries, where the only thing moving is maybe a few sheets of paper. The service sector updates servers and instals new software to speed up communication, decreasing the labour costs required to create a completed product, while the manufacturing sector strives to negotiate cheaper shipping rates and load containers with merchandise to minimise unit cost.

Completed Goods: A completed good is often a product that has undergone a full transformation from a form that is made of raw materials to one that is prepared for sale to the consumer. It is a tangible item that has been built, examined, tested, and packed; it is now on a shelf in a warehouse or a shop, prepared for sale. A completed product in the services supply chain is equivalent to a closed file. There is no longer any actual proof of the loan, property sale, or class completion other than a few pieces of paper. The aim of any final result is a consumer who is happy with the good or service she purchased, however.

Examples of Supply Chain Optimization: In a manufacturing firm, supply chain optimization is typically achieved through increasing delivery speed and lowering cost. Companies strive to get better prices on raw materials and decrease physical bottlenecks and inventories. Finding a quicker means to transfer or handle the components is the major strategy for accelerating manufacturing. On the other side, relationships and information flow are what drive optimization most in a service model. A firm may save money by forming alliances with businesses whose capabilities match its own. A service provider may achieve the same objective as a manufacturer by removing virtual bottlenecks brought on by additional approval loops or other intangible delays: a lower-cost completed product that is delivered to the client more rapidly.

When you open a Coke can the next time, look at the can a little bit more closely rather than the drink inside. The move from cone top to flat top soda cans by soft drink producers in 1957 made cans considerably simpler to stack, carry, and display on shelves, which resulted in significant cost reductions for businesses in the sector. The revolution in soda cans is an illustration of how product design for supply chain can increase a company's efficiency and save expenses. Nearly 50 years later, effective product design is a competitive advantage that can be used for strategic gain rather than merely a technique to squeeze out cost savings. It is widely accepted in supply chain management today that efficient upstream operations lead to efficiency further down the supply chain. For example, consider the extent to which suppliers are starting to assist customers in reducing supply chain volatility through techniques like vendor-managed inventories (VMI) and cooperative planning, forecasting, and replenishment (CPFR). Imagine moving even farther upstream in the manufacturing process, to the product development team, not only the provider of the product's components but also the supplier of the product's original idea (PDT). In order to further the concept of end-to-end cooperation, IBM's Design for Supply Chain (DfSC) initiative goes backward and optimises manufacturing before it ever starts. A product may be built from the bottom up to be really supply-chain efficient by using a product lifecycle management approach as early as the conceptual design stage.

Optimizing the match between product designs and supply chain capabilities is the practise of "design for supply chain." It develops product configurations that take into account infrastructure constraints and make advantage of supply chain capabilities as they change throughout the course of the product's life. Minimal component prices are still a competitive advantage in today's supply chain, but the supply chain that can provide the best performance at the lowest total cost is quickly evolving into a far more significant and long-lasting differentiator. DfSC employs a number of supply chain management procedures and methods to boost client satisfaction, cut down on overall expenses, and enhance flexibility in the face of unforeseen circumstances. It represents the fusion of some of the most cutting-edge techniques used in supply chain and product design today.

This is not a simple process, however. PDTs are often already overburdened with product design considerations due to strict budgetary limitations and a profusion of client expectations to take into account. However, by delving into the fundamental what, where, when, why, and how of DfSC and providing answers to these questions, we can inform PDTs and ourselves on how to design our products for supply chain effectiveness. These techniques assist a PDT in managing the creation and maintenance of complex goods and services throughout the course of their full lifespan, from product design and development to post-sale support.

Implementing Design for Supply Chain has certain problems, but there are also developing business tools to enable this kind of integrated process. One such technology is service-oriented architecture (SOA), which enables the IT infrastructure's many components to be integrated in order to handle all of the associated operations required to run this sort of process. When using DfSC strategies, company owners should take into account all end-to-end elements that might either assist or hurt their performance. When starting this path to enhance not just the way your firm creates new goods but also to save money and increase flexibility in your supply chain from beginning to finish, organisational culture, IT systems, and information accessibility are all aspects to take into consideration. The Nine Essential DfSC Techniques

1. Enhance Product Integration Levels: The ideal degree of pre-assembled components or integration at an upstream supplier should be determined by PDTs. This can be a challenging choice because, despite the fact that integrated components can decrease the number of parts that must be managed in final assembly and enable a reduction in assembly time (often by limiting the number of physical interconnections on the manufacturing line), this bundling of P/Ns can increase supply risk in a number of different ways. First, since each integrated component provides a different demand variable that must be taken into account when forecasting demand for the whole part, it might be harder to predict demand for the part with accuracy. Second, for an integrated component, aggregate lead times can be prolonged. Consider a scenario in which there are two components, each having a one-week lead time. The components may ship on the same day from two different sources and arrive at production the next week for assembly. A longer aggregate lead time results from the need that the first component ship to the supplier of the second component prior to the typical lead time of one week.

A common building block used across various offerings increases the value of disintegration by allowing postponed features to use a shared supply. Other factors to take into account when making this decision include the degrees of commonality, modular design, universal function, and postponement that can be imbedded in the integrated part. While keeping component costs competitive is always vital, there are few instances when total savings may be gained even when part costs are raised individually.

2. Leverage Industry Standards: Unless using proprietary components is warranted to gain a competitive edge, use industry standard parts. Standard parts don't need special labelling or other criteria; they just utilise the vendor part number. Instead of depending entirely on their capacity to estimate demand for the special item, suppliers may pool demand throughout the industry by using industry standard parts. Industry standard components also promote enhanced supplier flexibility and make it easier to dispose of surplus stock efficiently when necessary. Therefore, if practical, industry standard components should be utilised unless using a unique item has a clear value addition. It is necessary to analyse objectively if adding unique qualities to commercially available components gives the impression of more control. Similar to that, it's important to keep an eye on the stockpiles of special components for original equipment manufacturer (OEM) customisation. PDTs should think about what features of the product will and won't be open to OEM personalization throughout the design phase and design the product to be line-fit to push back any OEM customisation as far as feasible. By not having to manage and maintain supplies of distinctive, high-value OEM goods, costs are kept to a minimum. These OEM-specific inventory should, wherever feasible, be held by the OEM.

3. Reduce Premium Freight: A significant amount of supply chain expenditures are often made up of Premium Freight and resources to accelerate Supply. DfSC strategies should be used to shorten lead times on crucial components while increasing the availability of backup parts in the case of a shortage in order to keep these costs to a minimum. At the back end, long lead times cause volume volatility. Flexibility in suppliers and interconnected components must be taken into account. Consider the trade-off between the need for low-cost flexibility to handle unforeseen occurrences and the lowest-cost option for properly predicted needs, for instance, while considering integration possibilities. Additionally, the product should be made such that it may use alternative parts with other current goods or be compatible and common with components from earlier models. Additionally, suppliers will be better able to reserve production capacity to meet demand and minimise the need for expediting if they are given demand predictions on a P/N level early. Finally, the total effect of engineering modifications on the supply chain should be assessed. This is crucial when taking into account heavier components, which will result in higher premium prices for expediting. It is also more challenging for suppliers to match demand projections when engineering modifications are made later in the design phase.

4. Design for Life Cycle: Throughout a product's existence, the supply chain should be accommodating of any future component or infrastructure modifications. These might be simple changes in product design, lower costs, or advancements in commodities, technologies, and infrastructure. In order to permit future changes with the least amount of disruption to the supply chain, PDTs should identify which of the product's components are likely to be altered over the product's lifespan. PDTs should organise the product after determining the changes that are likely to happen so that adjustments may be executed with the least amount of supply chain disturbance. A proactive transition out of outdated technology while introducing new technology is crucial for product design. When the older technologies become more difficult to get, extended technological transitions add complexity and may be quite costly. Forward and backward compatibility must be taken into account in the product design, not only from the perspective of the client but also for supply chain component components. For low-volume components, design teams should create risk mitigation strategies to prevent excess inventories or lowered service levels when a technology reaches its end-of-life.

5. Configure the Selected Supply Chain: Choosing and setting up the supply chain should be the responsibility of a cross-functional product development team, not its creation. It is important to build supply chains on the company's strategic network strategy rather than specific items. The volume, complexity, and customization of the market are important considerations when choosing the ideal supply chain. When choosing a supply chain, there are various crucial factors to take into account. PDTs should first decide if the run rate (high volume) or enterprise (high complexity) model matches the product the best. In order to customise the supply chain to meet the needs of each product, design should first identify what makes the product distinct from others that share the same supply chain architecture. Third, PDTs should outline how cycle time and inventory objectives will be met, as well as the geographic distribution of consumers. Fourth, design teams should carefully consider how many (or how few) alternatives the final product will need. Allowing clients to customise a product to match their own demands is the pinnacle of delay. In order to reduce supply chain complexity, it is necessary to design fulfilment of optional features that accompany the product. The last selection factor is whether and how a

product will switch across supply chains in order to optimise profitability at the beginning, middle, and end of its life.

6. Design for Demand & Supply Planning: Designs that make use of DfSC principles include requirements for postponing "pool demand" and commonality, modular design, and universal function. The capacity to effectively estimate demand during lead time is improved by pooling needs on a single component and reducing variability. Although it is desired to reduce component count, postponing may be preferable when attach rates are poor. Hardware and service bundling and the possibility of unbundling terms and conditions are additional factors for demand and supply planning. Bundling services and terms and conditions (T&Cs) with hardware complicates planning since they are not planned. Infrastructure systems should enable the addition of the appropriate services to hardware and software to be delayed until the end of the manufacturing process in order to reduce complexity and give customers more freedom to choose precisely which services they desire. This will avoid bundling a product with predetermined services.

7. Reduce Inventory Costs: Carrying expenses and obsolescence risk are the two main inventory costs to take into account. When a product prefers a build-to-order (BTO) supply chain model as opposed to a build-to-stock (BTS) supply chain, carrying costs may be minimised. Additionally, by planning for maximum component velocity through the supply chain, inventory value and cost take-downs while inventory is retained are reduced. Utilizing quick lead times and readily changeable components, obsolescence risk may be reduced. Designing for high velocity movement will reduce the risk of obsolescence in a similar way as carrying expenses. By enhancing flexibility, bespoke configuration at the end of the production process will reduce risk. In the event that obsolescence does occur, PDTs should arrange product components for reuse in the next product transition.

8. Improve Order Administration: When designing a product, take into account how to make order management and customer fulfilment easier. The design of the product should be changed to provide the client as much flexibility as possible at little or no extra internal expense. This may be done by facilitating postponing and unbundling P/Ns using DfSC approaches, which will reduce complexity and increase flexibility and order management. PDTs should take into account how simple it is to enter unique orders and manufacture them. The organisation of the bill of materials must take use of order management systems' capabilities and make it easy for production to receive requirements quickly and accurately.

9. Reduce Warranty/Service Expenses: A dependable, high-quality product with easily diagnosable problems and customer-replaceable components that have a high warranty redemption value would reduce warranty costs. Increased flexibility in the use of alternate components for servicing may be achieved by using DfSC procedures. Even when common components for base unit production did not make good commercial sense, a common part for warranty usage may be advantageous. Reducing the number of components that must be kept on hand for service and warranty reduces costs and improves service standards. This is particularly crucial for the components with the greatest incidence of usual defects. Additionally, designs that include automated internal diagnostic capabilities may result in higher component prices but significantly lower total costs by making it easier to detect defects. When weighing higher component prices against service charges, the adoption of a serviceability assessment tool (SAT) to produce a service cost estimate might be an important decision point. Product testing that

detects both intrinsic and systemic failure modes, followed by the configuration of the product and the supply chain to cost-effectively address them, and may increase the profitability of maintenance contracts. "In order to achieve the "ideal product launch," enterprises must be able to plan for the supply chain. In order to successfully launch a product, it must be developed and supported throughout the course of its entire lifespan, from product design to product production to post-sale servicing. Customers realise supply chain economies by implementing product commonality and reuse thanks to decreased complexity, enhanced product quality, and improved production design. With these design ideas in place, customers may benefit from being first to market, increase profit margins, and lower overall expenses."

A supply chain is defined by the movement of goods and information among and between commercial organizations, such as suppliers, manufacturers, and clients. Meeting customer demand is supply chain management's ultimate objective efficiently. Making the right product in the right quantity, for the right client, at the right time is the goal for a manufacturing firm. Supply networks must be properly planned for this. A thorough examination of current models and techniques for supply chain design and analysis. The structure of a supply chain is determined by its design, which centers on where decision points are located and the design's goals. A smart design should priorities the chain's optimization above the optimization of a specific component. The bulk of supply chain design papers that have been published have emphasized important strategic problems. Instead of particular tools for plant managers, the outcomes are often general advice for corporate leaders. The strategy presented in this study may be used by a plant management to choose suppliers according to the kind of outsourced components. Supply chain operations reference (SCOR) model level I performance measures are used to guide decisions. The decision-making process is carried out using the analytical hierarchy process (AHP). The next section explains the rationale for using AHP before outlining the approach.

Design for Manufacturing (DFM) is the process of creating goods, parts, or components that are simple to manufacture with the aim of producing them more affordably. This is accomplished through streamlining, improving, and perfecting the product design. Sometimes DFM and the abbreviation DFMA (Design for Manufacturing and Assembly) are used interchangeably. During a DFM, five principles are explored. As follows: Process \sDesign \sMaterial \sEnvironment \sCompliance/Testiing

DFM should ideally take place early in the design phase, long before tooling has started. All parties involved in the project, including engineers, designers, contract manufacturers, mould builders, and material suppliers, must be included in a successfully completed DFM. This "cross-functional" DFM's goal is to question the design and examine it from all angles, including the component, sub-system, system, and holistic levels, to make sure it is cost-effective and optimal.

The impact of an early DFM is well shown in the following graph. Changes grow more costly as the design moves through the product life cycle and are also more challenging to accomplish. Early DFM enables rapid and inexpensive site execution of design modifications.

Even though questioning the initial design is an essential component of a full DFM, bringing stakeholders together early in the design process is simpler if you're creating a new product. By copying an earlier design, errors in a design are all too often replicated. Examine each component of your design.

DFM Principles:

1. Process: The item or product must be manufactured using the appropriate manufacturing procedure. To create a low-volume item that might have been produced using a lower-capitalized technique, like thermoforming, you wouldn't want to utilise a very capital-intensive process like injection moulding, which requires the construction of tools and dies. That is a classic example of overkill using a tank to destroy an anthill. Let's hear from Jeff on choosing the best manufacturing process: The amount of pieces being manufactured, the material being utilised, the intricacy of the surfaces, the needed tolerances, and if additional processes were necessary were all factors taken into account by the DFM.

2. Designing: Design is important. The item or product's actual design has to follow acceptable manufacturing practises for the manufacturing technique you've selected. Here is Jeff discussing the mouse's design. The following guidelines would be applicable, for instance, in the case of plastic injection moulding: Wall thickness that is constant, allowing for rapid and constant component cooling

Suitable draught (1 - 2 degree is usually acceptable)

For each 0.001" of texture depth on the side walls, the texture is required to be one degree.

As a general rule, ribs equal 60% of the nominal wall.

Simple changes between thick and thin characteristics

Wall thickness shouldn't be too thin since this raises injection pressure.

No side actions or undercuts; all features are "in line of pull/mold opening."

Consult the trade association for your manufacturing method to determine what is appropriate for that process, and specify the loosest tolerances that enable a satisfactory result.

Talk about the design with your contract manufacturer so they can make sure it complies with acceptable manufacturing practices for the chosen technique.

Material: It's critical to choose the appropriate material for your component or product. In this video, Jeff discusses some of the factors that influence that choice:

Some material characteristics to take into account during DFM are:

Electrical properties: Does the substance need to be dielectric that is, an insulator rather than a conductor in order to function. Once again, be sure to talk about the material with your contract manufacturer. They could have access to materials that are already in their portfolio and be able to help you negotiate a reduced material price.

Environment: Your component/product must be built to survive the environment to which it will be exposed. If the component cannot operate correctly under typical operating circumstances, no amount of form will matter.

Compliance/Testing: Standards for product safety and quality must be met by all goods. These standards might be third-party standards, internal standards set by the firm, or standards set by the industry.

Factors Impacting DFM: DFM seeks to lower production costs without sacrificing performance. Here are five elements that may impact design for manufacturing and design for assembly in addition to the DFM principles:

1. Reduce the Part Count: The simplest approach to save costs is to lower the number of components in a product since you are decreasing the quantity of material needed, the amount of engineering, manufacturing, labor, and even shipping expenses.

2. Standardize Materials and Parts: Customization and personalization cost money and take time. Utilizing high-quality, standardized components helps accelerate manufacturing since they are often on hand and their uniformity can be more reliably guaranteed. Material is determined by the product's function and intended usage. Consider:

3. Create modular assemblies: If you use non-customized modules or modular assemblies in your design, you may change the product's functionality without affecting how it works as a whole. An easy illustration is a basic vehicle that enables you to add additional by installing a modular upgrade.

4. Create Joining: That Are Efficient: for alternatives to screws, fasteners, and adhesives to link pieces. Here are some suggestions if you have to utilise fasteners: Reduce the number, size, and variety of fasteners as much as possible. Utilize common fasteners as much as you can. For optimum positioning, use self-tapping and chamfered screws. Avoid using separate washers, tapped holes, round and flathead screws, separate washers, and screws that are excessively long or short.

5. Reduce Parts' Rotation during Assembly & Machining: The design of parts should minimise the amount of manual labour required during manufacture and assembly. Reduce the number of manufacturing operations and processes, point number six. The more variables there are for mistake, the more difficult the manufacturing process is. Keep in mind what Jeff said: Every process has capabilities and limits. Include just those processes that are necessary for the design to work.

6. Describe "acceptable" surface finishes: Choose a surface finish that serves a purpose rather than being spectacular, unless it must be suitable for a trade display.

CONCLUSION

A significant competitive advantage against the escalating competition might be a highly effective supply chain that provides the most flexibility and customer service at the lowest cost. Supply chain disruptions may be avoided, and the costs of change can be kept to a minimum, by employing Design for Supply Chain methodologies to optimize goods at the design stage, before production even starts, or in some circumstances after it has. Any product design team may use the DfSC tactics and principles mentioned above to create products that enable the supply chain to effectively meet consumer expectations, whether they are designing for a high-tech server or a high-volume consumer offering.

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CHAPTER 20

SUPPLY CHAIN MANAGEMENT STRATEGIES IN SUSTAINABILITY

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Abstract:
Speed, cost, dependability, optimization, and ongoing supply chain improvement are the main concerns of supply chain management. Global supply chain sustainability initiatives concentrate on objectives that are eco-friendly, enhance resource efficiency, and simultaneously maintain or raise ROI. The use of sustainable chain management extends from the acquisition of goods and services to the timely delivery of the appropriate commodities. Sustainable sourcing, manufacturing, packaging, and optimal, responsible transportation of manufactured products are all aspects of a strategic business decision known as the sustainable supply chain. SCM sustainability initiatives are part of an organization's CSR initiatives, which promote green operations, cost savings, and enhanced supply chains over time.

Keywords: Strategies, Sustainability, Supply Chain Management.

INTRODUCTION

The term "supply chain sustainability" refers to a company's efforts to take into account the effects that their products will have on both the environment and people as they move through the supply chain, from sourcing raw materials to production, storage, delivery, and every transportation link in between. The term "sustainability" has gained a lot of popularity in today's corporate sector and throughout a wider spectrum of society. For instance, it's impossible to pass by a newsstand without coming across at least one magazine cover that discusses climate change, renewable energy, or the classic polar bear floating on a thin sheet of ice. There are a number of factors contributing to the increasing importance of sustainability, such as the supply and demand dynamics surrounding energy consumption, a better understanding of the science behind climate change, and increased transparency regarding organizations' social and environmental policies. Managers should be concerned about these issues because their stakeholders - including customers, governing bodies, non-governmental organizations, and even their own employees - are increasing their demands that businesses address and manage the environmental and social issues that are impacted by their operations. Supply chain managers have a unique opportunity to influence environmental and social performance, either favorably or badly, via actions including supplier development, mode and carrier selection, vehicle routing, site selection, and packaging[1]–[3].

The adoption of sustainable supply chain methods has been heavily stressed over the years by growing globalization, basically bringing up new opportunities in an age of heightened competition. However, knowing this source of persistent competitiveness has pushed companies to adopt creative tactics for boosting enterprises' progress. A solid strategic plan, the sustainable supply chain strategy aids businesses in overcoming market competition and obtaining a sustained competitive advantage. According to the report, using this example, the sustainability

strategy creates value across the manufacturing chain, maybe uncovering new sources for standout benefits. In light of this, the research recognizing SSCS as a sustainable benefit claims that in the supply chain network, the sustainable strategies allow the firms to enhance competitiveness, resulting in the acquisition of a sustainable competitive advantage.

In particular, the successful SSCS helps the enterprises to coordinate their business operations, so strategically reinforcing their commercial position. Given the instance, the study demonstrates that the sustainability triple-bottom-line aspects (e.g., social, economic, and ecological) help SSCS attain a dominating position in the marketplace. As a consequence, in order for a business to operate internally and achieve its sustainable aim, sustainability strategies are now essential. The secret to achieving sustainability is to persevere in an environment that is becoming more and more competitive while still achieving long-term competitive stability. The SSCS helps corporate operations by proactively controlling market developments in the supply chain business environment. Based on this assertion, the study demonstrates that the SSCS gives firms competitive advantages, enabling them to operate in a dynamic business environment. Importantly, the SSCS gives the businesses a first-mover advantage by putting them ahead of competing enterprises. The growing environmental concerns in recent years have prompted management to pay more attention to sustainability initiatives. Ecological concerns have a significant impact on the value chain system in the supply chain, necessitating the adoption of efficient techniques and sustainable business practices across the whole network. As a result, many businesses today have embraced SSCS to increase ecological wellbeing. Given the articulation, the research reveals that the enterprises' sustainability initiatives lower the environmental cost, hence maximizing the societal welfare with sustainable practices.

Sustainable supply chain methods in particular help the businesses achieve the sustainable triple-bottom-line dimension. In supply chain modelling, firms' long-term strategies and ethical behavior are focused on enhancing their performance. Perhaps, knowing this multi-dimensional sustainability allows firms to support organizations' activities with a sustainable vision. Sustainable business practices are successfully implemented as a result of the businesses' sustainability strategy. Due to this, many businesses have begun adopting the idea of sustainable practices that support their sustainable aims. By demonstrating improved organizational performances, the research illustrates how the SSCP helps firms accomplish their sustainability goals. It may be argued that numerous problems increase the need for sustainable solutions. Companies in the pharmaceutical sector have recognized the need for sustainability practices to achieve a commercial objective in order to meet sustainability criteria. The drive to increase the competitiveness in the pharmaceutical sector has pushed the firms embrace sustainability strategies, greatly decreasing the rising effect of ecological problems (i.e., chemical waste, inhibitors). The support of environmentally friendly strategic plans, strategies, practices, and policies in particular, claims the global health organization, aids the organization in directing management and protecting the environment.

Competitive Advantage and Sustainable Supply Chain Practice

Environmental sustainability has gained more importance in supply chain management during the last several decades. The rapid worsening of the environment in recent years has forced the stakeholders to implement eco-friendly methods in order to secure the long-term benefit. The sustainable traits of the companies (such as their activities, policies, and procedures) assist them in gaining a sustainable competitive advantage. Given this articulation, the research demonstrates

how adopting SSCP causes businesses to include sustainability features, resulting in high levels of organizational performance and competitiveness. Without a question, the most potent force behind supply chain sustainability is competition. It exerts pressure on businesses to adopt sustainable practices in order to achieve a competitive advantage. Businesses set themselves apart from their competition thanks to their durable competitive edge. In fact, SSCP is essential for preserving market competition. By concentrating on long-term stability, sustainability policies help the firms outperform their rivals. Given this example, the study discovered that using sustainable supply chain practices gives the business a long-term competitive advantage and boosts organizational performance. However, the competitive advantage of the enterprises is a key factor in the company' performance. Organizations can maintain a distinct advantage over their competitors by integrating sustainability practices into their core business operations. As a result, the study demonstrates that the SSCP improves the businesses' strategic assets, resulting in SCA. In fact, the practice of a sustainable supply chain enhances the businesses' operations by enhancing their competitiveness. Therefore, the study advises that businesses should concentrate on sustainability practises to maintain a competitive advantage over other firms given its growing significance[4]–[6].

The goal of the research is to determine the contribution of supply chain management techniques to environmental sustainability. Thailand's manufacturing enterprises were chosen for the research owing to their wide range of environmental impacts. Furthermore, the importance of supply chain management solutions for sustainability has not received sufficient attention in poor nations. A questionnaire has been used to gauge the replies of the supply chain workers at a manufacturing company in Bangkok. In order to quantify the contribution of various supply chain management strategies to environmental sustainability, structural equation modelling has been used. According to the study's overall findings, facilities, inventories, information, sourcing, pricing, and transportation all play important and advantageous roles in sustainability. The model's strength is increased by the moderator interaction of information technology. Inventory management is the one that contributes most to the long-term viability of green initiatives in manufacturing businesses. Tools for efficient inventory management quickly decrease waste and save the environment. To provide a secure and protected environment, supply chain and inventory procurement managers should create green supply chain management, remanufacturing, lean production, applications of six-sigma methods, and environmentally friendly packaging.

In order to make the management of the former easier, the current study suggests a comprehensive framework for supply chain strategy (SCS) analysis that is tailored to the unique traits of the agrifood chain. The horticulture supply chain, which started in Spain and ended with the European customer, was examined specifically as a case study, using the marketing firms at the start as a point of comparison (mainly social economy companies, that is, cooperatives). In order to establish whether explicit cooperative development plans could include horizontal and vertical cooperation partnerships with other chain members, a survey of marketing organisations is also done. The goal was to examine the important elements of the horticulture commercialization company's supply chain partnerships with each partner. A model that examines how cooperation affects business success was also taken into account. The findings show that the idea of sustainability within a framework of customer cooperation has recently overtaken and superseded criteria relating to quality and health. Additionally, it has been shown that working with upstream partners is often more lucrative than working with downstream

partners. In any event, it became clear that in order to increase the chain's profitability, cooperation must be increased by bringing in the supplier of the supplier.

In a time when stakeholders are demanding more social, environmental, and economic sustainability, poorly managing suppliers may place a firm at significant sustainability risk and seriously damage its brand and bottom line. From the standpoint of agency theory, this study investigates how to execute a corporate sustainable supplier strategy intended to manage such risks. perform a case study of a global company that offers top mobility solutions for escalators, moving walkways, and elevators. Data is gathered from a variety of sources, including as strategy papers, focus group discussions, and semi-structured interviews. Results: The study identifies a number of implementation issues and coping mechanisms in two different relationships: first, the agency relationships between the regional subsidiary units and their suppliers, and second, the agency relationships between the regional subsidiary units and their headquarter. Research limits and implications: A conceptual framework is presented to conceptualise the use of sustainable supplier practises. The framework places the subject at the intersection of supplier quality management, agency relationships, and supply chain sustainability risk and suggests directions for further study. The two main restrictions were the use of a single case study and the exclusion of suppliers from the data collecting process. Practical ramifications: Using the suggested framework, global corporations may establish and execute corporate sustainability plans across their supplier networks. Value and originality: The framework's integrated strategy integrating supplier quality control, supply chain sustainability risk, and triadic agency interactions makes it unique.

For major enterprises, implementing sustainability standards in the modern, intricate supply chain network (SCN) has been a significant problem. Understanding how focal enterprises' decision-making processes may be impacted by how deeply they are ingrained into a larger stakeholder network is necessary to construct a sustainable SCN. Despite the growing body of research on sustainable supply chain management (SSCM), little is known about the interactions between focus enterprises and their SCN players with regard to sustainability practises. This study examines how the structure of the SCN affects the relationship management strategies (RMS) of the target enterprises and suggests potential implementation methods for sustainable practises throughout the SCN. A web-based poll was conducted to gather information from 66 Australian food suppliers and manufacturers who are part of the SCNs of two major retailers. Exploratory factor analysis was used to verify the paper's constructs, and hierarchical multiple regression analysis was used to evaluate the hypotheses. Transparency, power, supplier dependence, buyer dependence, and distance were the five components of the SCN structure that were found to ascertain the effect of the SCN structure on four RMS (non-compliance, transactional, dictatorial, and collaborative). The findings reveal various correlations between each element and RMS, offering fresh perspectives on how sustainability measures are being implemented in the SCN. The results might help managers balance resource allocation for managing sustainable activities within their businesses' SCNs. This article is one of the few empirical studies that looks at how SCN structure affects RMS in SSCM[7]–[9].

One of the fastest-growing waste sources in the world is electronic garbage. But in 2019, just 17.4% of it can be gathered and repurposed. The purpose of this research is to develop solutions for enhancing the Indonesian e-waste management supply chain. Strengths-Weaknesses-Opportunities-Threats (SWOT), the Analytical Network Process (ANP), Strength-Weaknesses-Opportunities-Threats (SWOT), and the Quantitative Strategic Planning Matrix were utilized as

methods to build strategies in this research (QSPM). The findings indicate that the infrastructure criterion, with a weight of 0.267, have the most weight, followed by the social environment (0.261), regulation (0.244), stakeholder (0.122), and economics (0.054). The improvement of public education (ST1) and the public's internalization of rules and penalties are the chosen tactics' main priorities (ST2).

Supply chains become more dependent on one another as a result of the difficulties faced by the world's economies, increasing their sensitivity to potential repercussions and operational disruptions that might jeopardise their sustainability. This has led to an increase in study in this area and the development of a new area of interest in supply chain management that views resilience management as a strategic skill of businesses. Supply chains should also address the economic, environmental, and social components of sustainability by include the three different kinds of goals in their plan. In order to boost competitiveness, supply chain management must include both resilience and sustainability. The purpose of this research is to evaluate resilience management and its relationship to improve supply chain sustainability via a thorough analysis of the literature. The study examines, categorises, and synthesises 232 peer-reviewed journal papers published from 2000 to February 2020 that are included in the ScienceDirect and Scopus databases. With the help of the findings, this study creates a conceptual framework that unifies the key components for assessing, managing, and increasing resilience in the supply chain. Conclusions, restrictions, and potential directions for further study are then presented.

The economics industry is currently developing toward sustainable supply chains. In order to achieve various goals, they need that businesses and governments possess significant capacities to confront such difficulties head-on and find long-term, intricate solutions. Using four various tactics in the differential game with regard to the three pillars of sustainability, this study creates decision models for the focal firm and supplier and improves the content of product sustainability. The consequences of subsidies and the incentives offered to the focus firm are then examined. The findings demonstrate the potency of the profit sharing ratio and the strong correlation between it and each member's earnings as well as the long-term viability of the product. In comparison to incentives, subsidies have a more substantial impact on advances in product sustainability, environmental performance, member earnings, and the whole supply chain.

The management of the supply chain and its sustainability are severely affected. Due to a lack of raw materials, necessary components, and manpower, several businesses were forced to shut. Few businesses were able to manage such a disruptive situation effectively. Studies on the best supply chain approach for such a volatile circumstance are few. Both academic scholars and practitioners are curious in how to handle this circumstance while enduring a COVID-19-like catastrophe in the future. In light of the above, the objective of this research is to investigate the factors that have an influence on the sustainability of the supply chain under challenging conditions. The research looks at how government regulations and business capacity affect the supply chain's sustainability amid unsteady conditions. A theoretical model has been built with the use of a literature study, dynamic capacity theory, and contingency theory. Later, the model was tested using the PLS-SEM method using 315 usable answers from workers at various Indian companies involved in the supply chain management process. The research finds that enterprises' competencies, the backing of the leadership team, and a contingency plan are crucial in helping to design the right supply chain strategy, which in turn has a beneficial influence on supply chain

sustainability under unsettling circumstances. The research also reveals that, in the face of uncertainty, government regulation has a moderating effect on supply chain management.

DISCUSSION

Sustainable supply chain: A sustainable supply chain aims to reduce or eliminate harmful environmental and social consequences while transferring commodities as swiftly and affordably as feasible to the downstream supply chain or end users. A supply chain that is sustainable is built on three pillars:

Financial sustainability: Given the connection between sustainability and longevity, a business with a sustainable supply chain should be able to provide a gratifying income to all of its stakeholders, including owners, investors, and workers.

Sustainability in regard to the environment: A sustainable supply chain should emit the least amount of GHG. Consumer goods companies emit the bulk of GHGs, or more than 80% of their total GHG emissions, under Scope 3 emissions (GHG emissions connected to supply chain, consumption, and disposal). Total consumption is rising as a result of the growing global population and GDP. Therefore, environmentally friendly supply chains are an effective instrument for lowering our carbon footprint.

Social sustainability: Human rights are respected throughout the whole value chain of a sustainable supply chain. A moral business associates with organizations that don't use child or forced labor. Despite the humanitarian aspect of the scenario, brand image distortions may result from a supply chain that is unconcerned with social sustainability. For instance, it was discovered last year that Starbucks' coffee bean suppliers used kids under the age of 13 to save costs.

Statistics on Supply Chain Sustainability

Many people have examined patterns in this field across sectors, nations, and impact regions as firms have increased their attention on supply chain sustainability. Here are a few noteworthy figures:

Demand: According to Nielsen, over half of American consumers said they would alter their buying patterns in order to lessen their effect on the environment.

Environmental effect: According to McKinsey & Company, the supply chain is responsible for more than 90% of the environmental impact of the majority of consumer products firms.

Societal risk: With 2018, when it introduced the Comply Chain app to assist American firms in removing child labour from their supply chains, the U.S. Department of Labor identified 148 different commodities from 76 different nations that were made using either child labour or forced labour.

Data structures: The Carbon Disclosure Project (CDP) conducted a poll in 2019 and discovered that 65% of its corporate members utilised environmental measurements to guide supplier management and keep their business partners accountable to supply chain sustainability targets.

Progress: Progress in reducing greenhouse emissions has been reported by CDP as being encouraging: A drop in emissions was recorded by 29% of the 7,000 suppliers to some of the biggest companies in the world in its 2019 study. Must maintain open lines of communication at

every level of the organization in order to align objectives and talk through any trade-offs. It may be unclear what the goals are and how particular compromises should be assessed if some people are focused on building the most economically advantageous supply chain while others are attempting to develop a sustainable one. As a result, there has to be continuous discussion regarding the objectives of each department in the business in order to make the best judgments.

Three components of a sustainable supply chain are:

Financial responsibility is a component of sustainability that takes into account the financial requirements of the shareholders, staff, clients, and partners in business, financial institutions, and other entities that contribute funds for product production or depend on the company for salaries or reimbursements.

Environmental responsibility is a component of sustainability that deals with the planet's ecological requirements as well as the company's management of the natural resources it uses in its operations. With this component, focus is put on safeguarding the environment and avoiding both immediate and long-term harm.

Social Responsibility: This sustainability component deals with the moral, ethical, and charitable demands society makes on a firm. It takes into account the concept of sustainable development, which emphasizes social advancement while preserving the environment.

One prevalent misperception regarding sustainability is that creating a sustainable supply chain is expensive. However, many of the tactics used to build a sustainable supply chain may also be economical. For instance, shortening the supply chain may assist save transportation costs by lowering the energy needed to move items through the process. Sustainability in logistics and supply chains has become a popular characteristic. Numerous factors can be identified as being present today, including exceptional maintenance quality, operating characteristics typical of a free market framework, and the emphasis on the so-called vitality, which can be attributed to a greater understanding of the science behind environmental change.

These characteristics are important to managers since all stakeholders are increasingly requesting an accurate evaluation of the environmental and social repercussions resulting from their actions and performances. The viewpoint of supply chain professionals is most suited to take into account how operational choices—such as those involving suppliers, transportation, vehicles, locations, and bundling options—will affect the natural and social environment. Additionally, businesses often function with input from other participants in a linked chain that begins with natural resources and ends with the ultimate customer. The regulation of the system is known as store network administration (SNA), whereas production network administration (PNA) deals with the capacity and development of raw materials, work-in-progress inventory, and the entire production process of goods from the beginning to the end. One of the key components of so-called corporate social responsibility (CSR), which integrates natural and social viewpoints into management choices and prioritizes product and process innovations in terms of monetary business objectives and environmental advantages, is sustainability[10]. For instance, excessive exploitation of the Earth's finite and priceless natural resources, such as land and water, competing interests between businesses and employees over low wages and unfavorable working conditions in order to increase earnings. Due to the necessity to lessen the adverse effects on the environment and society, awareness of the need of an effective and efficient inventory network is growing. The sustainability of the shop network was given priority by management, consumers,

investors, and worldwide conferences as a result. Better management tools are being developed as a result of several forces that want to guarantee that businesses act responsibly in terms of the environment and society and that their consumers do as well; national leaders are also focused on sustainable policies. As a result, more research is being done on Sustainable Supply Chain Management (SSCM), and more businesses are incorporating sustainable practices into their operations. These studies cover every important aspect of SSCM.

This article's main goal is to give a systematic evaluation of sustainable supply chain and logistics management by selecting the top academic research papers and bolstering the methodological research to improve knowledge of SSCM from a wider angle. A summary of a comprehensive investigation of the logistics flow determination and SSCM is also given.

Benefits of Sustainable Supply Chains

Sustainability of the supply chain helps society and the environment as a whole in addition to serving the interests of the firms themselves and their stakeholders. Companies are becoming aware that factors like climate change, such as major weather disruptions and rising resource scarcities, might jeopardize their ability to conduct business as usual. Five often mentioned business operations that profit from sustainability are listed below:

Operations in the supply chain: Recent instances demonstrate that energy costs fall, for instance, if corporations establish emission objectives with suppliers and assist them in identifying possible improvement areas.

Branding: Where things originate from and how they are made are now more important to consumers than ever. Consumers may be willing to spend 2-10% extra for goods that provide supply chain transparency, according to research from MIT's Sloan School of Management.

Institutional investors are acutely aware of the reputational risk associated with unsustainable supply chain operations. Numerous careless supply chain practices have been exposed by the media in recent years, and in some instances, this has lowered a company's stock price. These stories have exposed companies buying electronics from other countries, maintaining unsafe working conditions, cooperating with vendors that habitually contaminated nearby waterways, and buying dangerous or faulty parts. It's also important to note that in a recent Gallup study, approximately 50% of investors indicated a desire for sustainable investing funds.

Corporate culture: According to demographers, Millennial in particular want for more meaning in their job. The corporate culture and values of an organization play a big part in successfully attracting and keeping personnel, and sustainability is one of those principles.

Compliance: In order to fulfil the 2030 deadline set by the United Nations for meeting the Sustainable Development Goals, such as providing everyone with access to clean water, governments throughout the globe are legislating more supply chain sustainability. The traceability of medications, electronic waste disposal, and the avoidance of conflict minerals are only a few of the numerous topics covered by government rules.

Sustainability of the Supply Chain ChallengesThe main barrier to more sustainable supply chains is cost, with smaller businesses finding it especially challenging to bear the initial expenses involved. However, a long-term investment in something like compact packaging, for instance, may result in fewer and smaller shipments, a smaller environmental impact, and cost savings.

Other businesses discover that there are just no sustainable component alternatives available or that they have supply chains from acquisitions that are challenging to convert to sustainable practices due to complexity or organizational design. These obstacles can be solved, but according to 20% of study participants, buyers just weren't interested. Some businesses find it challenging to justifiably explain the extra cost or effort as a result.

Customers, staff, and investors are increasingly turning away from companies that don't set sustainability targets. Instead, they are looking to their more environmentally friendly rivals, those that develop recyclable items, produce using materials that are ethically sourced or recycled, and provide goods with little waste or carbon emissions. Our global supply chains are bang in the center of these concerns, as a significant contributor to the issues and an excellent area of emphasis for taking action. Climate change, circular economy, ESG, and sustainability have become corporate objectives. Here is a five-step action plan to think about as many businesses begin their sustainability journey: Create a sustainable business plan: Businesses must priorities sustainability as a key component of their entire business strategy. Business executives must look at every aspect of their network to uncover sustainability flaws both within and outside of their own company. For instance, supply chains have a significant role in waste carbon emissions and provide a significant potential for development. By setting measurable objectives to improve a company's supply chain (such as getting rid of single-use plastics within the next 18 months or going carbon neutral by 2030), stakeholders such as customers, investors, employees, and other parties can once again have faith that the company is actively working to improve its sustainability.

Integrate Sustainable Data into Business Networks and Processes: Business executives must evaluate their performance after setting the first objectives and utilize the data gathered from the whole supply chain to improve operations. Sustainability must include all aspects of product development, including product design, raw material procurement, manufacturing, last-mile logistics, and even product use, returns, and recycling procedures.

The ability to easily share sustainability data with suppliers, shareholders, industry associations, regulators, and customers will help keep businesses accountable and help them meet the sustainability goals they have set. Having sustainability data from within an organization and across the network of partners will also help businesses stay in compliance.

Throughout the supply chain, control carbon and climate exposure: Supply chain executives should ensure they are accounting for and controlling climate-related emissions throughout every segment of their supply chain, including suppliers, contract manufacturers, and logistics service providers, and other trade partners, after the initial data collection. This is no easy task; business executives often struggle to control the overall carbon footprint of goods due to a lack of visibility throughout their supply chains. Business leaders may act to minimize their organization's overall carbon footprint by using technology to provide them the insight they need to see throughout their supply chain. Although altering the supply chain may seem like a big task, it will surely be worthwhile in the long term thanks to a more devoted consumer base.

Accept Circularity and Develop Regenerative Behavior: Utilizing technology may assist businesses in reducing waste by reusing, recycling, and using recovered resources. This will eventually lead to the adoption of a circular business model. By 2030, circular economy strategies supported by digital technology will provide businesses up to $4.5 trillion in new prospects for economic development, according to Accenture. Colgate-Palmolive is a prime

example of a business that values circularity. It promised to use less virgin plastic and to utilize only recyclable, reuse, or compostable materials for consumer packaging by the year 2025. Colgate-Palmolive uses technology to access data throughout the entire supply chain, which has been crucial to the continued development of innovative, sustainable goods. Companies must design goods with their end of life in mind if they want to attain circularity and become regenerative. To avoid non-biodegradable packaging materials ending up in landfills or the ocean, R&D executives and product designers should ask themselves questions like "how will the product be refurbished, recycled, reused, or returned to the earth." In order to satisfy our corporate responsibilities, we may use sensors to identify which items are harming the environment and feed that information back into the creation of new products.

Put people first throughout the supply chain: Companies need the buy-in and support of the whole workforce when implementing a sustainable company plan. The first step in doing this is to respect the workforce, foster diversity and safety, priorities human rights, equality, environmental health and safety, and provide chances for people to further their careers, such as training and reskilling programmers. Business executives also have a duty to collaborate with vendors, subcontractors, and logistics service providers that uphold these principles. Sustainability requires a collaborative effort from many organizations in order to repair and eventually safeguard the prosperity of our ecosystem. Business leaders that are just beginning their sustainability journey are at a turning point when they are motivated to take action. It will probably take society years to achieve significant progress, but corporate executives that emphasize their green line as much as their profit line will eventually make huge strides in resolving the biggest environmental problems facing the planet.

Emerging economies are already attracting more attention in supply chain sustainability discussions thanks to global marketplaces. Researchers have interchanged the terms emerging and developing economies, despite the fact that there is no widespread consensus on the definition of an emerging economy. These economies are distinguished by lower levels of commercial or industrial activity and per capita income, a lack of infrastructure, and economic growth rates that are comparable to or greater than those of industrialized nations.

Their rates of economic growth make a significant difference. The labels "emerging" and "developing" economies will be considered interchangeably for this research's purposes since them both show traits that are comparable to those discussed in the literature on SSCM in emerging countries. However, it is crucial to emphasize that in other types of research it would be necessary to separate them in order to account for their differences. Therefore, it is precise to identify such countries as crucial participants in global supply chains and sustainable development; especially since operations like extraction, manufacturing, assembly, and production are carried out in their location. From this viewpoint, emerging economies, also known as emerging markets, are distinguished by being in a development process as contrasted to developed nation, and have assumed a leading position on their contributions to initiatives and practises on sustainability [68]. The unique problems with SSCM in developing nations, however, have not received as much attention from study as they have in rich nations, and a wealth of SSCM literature has highlighted this issue. Understanding the importance of SSCM programs for emerging countries and the unique organizational issues that these markets face were about how SCM supports the sustainable objectives of multinational companies working in

developing nations. By examining SSCM techniques in the context of global chains provided by poor nations. The connection between social concerns and corporate operations has also been recognized in literature from the standpoint of social sustainability. Supply chain management in developing countries is related to corporate social responsibility. In addition to developing markets, the adoption of socially responsible operations with suppliers across the supply chain. The impact of nation location, business size, and position in the value chain on the adoption of corporate social responsibility policies.

Widely supply chain management efforts were used by enterprises in developing nations, sustainability is crucial to the success of these programs. The instance of a Brazilian oil and gas supply chain from the viewpoint of the focal firm and showed how it was successful in changing its chain when it adopted sustainable practices, also gave a brief overview of supply chain features in emerging countries by examining sustainable methods and how they are used in comparable economies. On the other hand, to allow the successful implementation of an SSC, obstacles to applying sustainable practices in the Bangladesh leather processing sector and analyzed the linkages between them. Globally speaking, developing nations are growing and displaying a significant role in the economy; multinational corporations want to introduce or source goods from them; and sustainable development is playing a significant part in this economic environment. Furthermore, supply chain activities in a global setting assert that rising logistical costs, complexity, market restrictions, and a decline in yields directly impact developing nations.

CONCLUSION

As a conclusion, it can be claimed that sustainable development promotes consistency in the demands placed on the environment. Future generations may utilize the resources because of it. A fantastic strategy for conserving the resources that nature provides is sustainable development. The planning of supply chain strategies will be strengthened and improved by supply chain sustainability. Efforts to maintain the supply chain will increase, and more businesses will embrace a circular supply chain approach.

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CHAPTER 21

CLASSIFICATIONS OF DRIVERS OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT

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Abstract:

Production, inventory, location, transportation, and information are the five supply chain drivers that affect how well the chain functions. Depending on your company and financial objectives, companies may design and manage these drivers to stress the perfect balance between responsiveness and efficiency.

Keywords:

Drivers, Financial, Sustainability, Supply Chain Management, Visibility.

INTRODUCTION

Customer wants and expectations are the driving force behind ongoing innovation in goods and customer service. Prioritizing responsiveness helps businesses to effectively adapt to unforeseen market swings and shifts in client preferences. On the other side, the drive for efficiency boosts output and drives down the cost of goods, making them accessible to a wide range of consumers. However, predictability and stability are necessary for efficiency, and both have proven elusive since March 2020. For the majority of businesses, improving responsiveness and efficiency is a never-ending struggle. Here each of the five drivers in further depth to show how business may better balance them and the benefits and drawbacks you should be aware of: Production: Make sure your facilities have surplus capacity and use flexible production methods to generate a variety of products in order to develop a responsive supply chain. Production can swiftly adapt to changes in customer demand because to its flexibility. Furthermore, having several smaller manufacturing sites adjacent to hubs for customers and distribution centres improves consumer demand responsiveness by cutting down on delivery times. As an alternative, efficiency is increased by having manufacturing facilities that have minimal surplus capacity and are designed to produce a certain range of goods. Although certain clients may experience lengthier delivery delays, centralising manufacturing at big central factories for better economies of scale furthers efficiency[1], [2].Inventory: Optimizing responsiveness sometimes necessitates stocking more products and at more warehouse sites when inventory is the driving factor. Effective inventory management enables fast response to unanticipated demand swings. The cost of storing is greater with this strategy, thus it must be considered against the advantage of wider accessibility. Reducing inventory levels is necessary for effective inventory management, particularly for commodities that don't sell regularly. Additionally, cost reductions and economies of scale are achieved by stocking goods in a small number of central distribution hubs.

Location: Making convenience a top priority for the site driver sometimes entails opening many locations close to consumer bases. Fast-food businesses, for instance, build a lot of locations in high-volume regions to be particularly responsive to their consumers. They can react swiftly to customer demand by having several locations, but doing so raises operational expenses. Operating from a small number of sites and centralising operations improve efficiency. An illustration of location efficiency would be how e-commerce firms service international markets from just a few core sites while carrying out a variety of tasks. This makes each location more productive, but it also leaves them open to interruptions, as was the case with the coronavirus epidemic.

Transportation: Even though they are often more costly, faster forms of transportation like air freight provide quicker deliveries and higher responsiveness. FedEx and UPS are two businesses that provide excellent last-mile responsiveness by leveraging transportation to deliver goods often within 48 hours. Transporting goods in bigger batches less often using bulk carriers like ships or railways emphasizes efficiency. This method of transportation is more effective when the items come from a single distribution hub rather than many different sites.

Information: As technology for gathering and distributing information becomes more accessible, user-friendly, and inexpensive, its influence as a driver is increasing. Analytics-based software employs both internal and external data to help supply chain drivers perform better. For maximum efficacy, your supply chain should gather and distribute precise and timely data produced by the preceding four operational drivers. Market-leading supply chain solutions allow businesses to maximize the use of information to boost internal responsiveness and efficiency via collaboration and end-to-end visibility, even while the cost of the first four supply chain drivers keeps going up. When circumstances and interruptions like the COVID-19 pandemic occur, scenarios equip supply chain managers to act swiftly and make strategic, educated choices based on key supply chain factors.

Highly complex supply chains have developed as a result of trends in supply chain management (SCM), including the globalization of market economies, shorter product life cycles, digitalization, and multifaceted customer expectations, as well as developments like resource scarcity, stricter regulatory requirements, and a more long-term focus. The performance of firms and their supply networks depends increasingly on the integration of environmental and social responsibility problems into supply chain management. Organizations are held responsible for their actions that have an impact on the environment, society, and economy of both their own companies and the other parties in their supply chain. As a consequence, sustainability in business operations and the supply chain has gained popularity today and become a significant subject of study. Adopting sustainability practices not only helps organizations and their supply chains perform better in terms of the environment and society, but it also gives them the chance to learn new skills that can give them a competitive edge when they engage in sustainability projects both inside and outside of their walls.

But numerous internal and external variables often have an impact on whether sustainability-related efforts are taken and sustainability practices are adopted. Organizations and their supply chains are urged or even under pressure mostly by various stakeholders to address sustainability issues brought on by their operations, in addition to the introduction of numerous new regulations pertaining to various sustainability dimensions, such as carbon discharges, greenhouse effects, carbon taxes, and anti-corruption. Therefore, the link between implementing

sustainability initiatives and their efficacy on the sustainability performance of the supply chain may be impacted by reactions to the needs of different stakeholders. To adopt sustainability practices throughout the entire supply chain, the focal organization within the network of the supply chain must, in turn, provide stakeholders with value and broaden its focus beyond traditional financial goals to include the crucial sustainability issues raised by various stakeholders. The failure to clearly define significant sustainability concerns may cause supply chain risks to be incorrectly recognized and therefore cause senior management to focus on other non-priority issues. Therefore, identifying the significant sustainability issues highlighted by various supply chain internal and external factors (also referred to as the drivers of sustainable supply chain management (SSCM) in the literature) not only encourages extensive stakeholder engagement but also helps to achieve overall supply chain sustainability goals.

There are several SSCM drivers mentioned. Despite the topic's accepted relevance, a method for allocating priorities based on drivers' significance to the supply chain and the extent of their effect there is still needed. It is unknown why and how many SSCM drivers there are [1,4]. There isn't a clear list of drivers of SSCM that can be used by practitioners to define their sustainability objectives and concentrate their sustainability-related activities in accordance with the order of importance determined by various stakeholders and drivers of SSCM. Practitioners may find it easier to comprehend crucial sustainability concerns, spot problems, and decide what changes are needed if the drivers of SSCM are clearly identified and categorised. Because not all SSCM drivers exert pressure on firms in the same manner [4], managers should carefully determine industrial priority. Therefore, the primary goal of this research work was to identify, characterise, and classify the drivers of SSCM in accordance with their level of significance and value contribution. In order to comprehend the present state of the drivers of SSCM and their roles in the execution of sustainability efforts, a thorough study of the drivers of SSCM was carried out for this aim. To investigate and comprehend the numerous SSCM drivers, institutional and stakeholder theories were used.

LITERATURE REVIEW

Muhammad Amad Saeed and Wolfgang Kersten [3] Stakeholders, particularly consumers, are expressing more concern about environmental and social concerns related to the creation and use of goods as knowledge of these issues rises. Organizations are now required to find and execute creative, sustainable solutions not just inside their own walls but also across the whole supply chain network in order to accommodate new developments and shifting trends. This paper's main objective was to identify and assess the sustainable supply chain management (SSCM) factors that promote or influence businesses to apply sustainable practices across their supply chains. A thorough study of the literature was done for this purpose, and 217 journal papers yielded 1559 drivers of SSCM. A list of 40 distinct SSCM drivers was created by precise interpretation, precise definitions, restructuring, and categorization into external and internal driver categories. According to the findings, market and regulatory pressures—as measured by the volume of citations—are the primary forces behind the adoption of sustainable policies. It may be helpful for practitioners and decision-makers to priorities sustainability-related projects and implement sustainability practices across the whole supply chain network if the drivers of SSCM are divided into major and secondary driver categories.

Dominik Zimon *et al.* [4] Characterizing the circumstances and obstacles pertaining to the implementation of the SDGs in supply chains is the primary goal of the research and analysis given in this paper. The authors' explanation of the defined research problem and the more in-depth research concerns lead them to propose the supplemental aims listed below: highlighting the connections between SSCM practices and UN SDGs and creating a model to enable their implementation in SSCM. A novel conceptual model and a dynamic framework for a three-phased model for the execution of successful sustainable supply chain management projects are among the contributions to the literature that come from our examination of data from this area of study, as summarized in this article. For novel theoretical insights that map supply chain patterns for future research and performance evaluation in line with the 17 Sustainable Development Goals of the United Nations, we provide a grounded methodology.

H Mann *et al.* [5] Local optimization is no longer the primary focus of sustainability; instead, the whole supply chain is. This study analyses the factors that drive businesses to develop sustainable supply chains. It is proposed to use an objective-oriented taxonomy to place supply chain management drivers in a sustainable context. This distinct viewpoint enables the distinct identification of the drivers and may serve as the starting point for further investigation into sustainable supply chain management. Introduction

Gunjan Soni *et al.* [6] The Indian marble and stone sector has the potential to make a significant contribution to the growth of the rising economy. The stone and marble industries in India, in contrast to the other industries, are much undervalued, which might be crucial for growth. This essay examines supply chain management strategies' sustainability considerations. Design/methodology/approach: The drivers and obstacles in sustainable supply chain management methods are determined by a survey of the literature. An examination of the driving and dependent powers, as well as a hierarchy of barriers and drivers, were obtained using interpretive structural modelling. Additionally, MICMAC analysis is used to categories the drivers and obstacles in terms of how they affect sustainability. Findings: According to the work of this study, society, the government, and commercial banks should pay more attention to how disorganized the stone and marble industry is. By enforcing more relevant rules and regulations and highlighting the significance of environmental awareness, stakeholders should be more committed to reducing pollution and implementing safety. Originality/value: This study's key contribution is to pinpoint the factors that influence and are influenced by sustainable supply chain management in the stone and marble sector. The research suggests a reliable mathematical model to order the important elements for ethical resource production and consumption from the sustainability perspectives of the stone sector [7]. Environmental sustainability is today one of the key concerns of business and the economic sector in a global economy defined by environmental, social, and economic aspects. There have been several magazines and specialized books written on the sustainable supply chain. The goal of this research is to pinpoint what motivates the adoption of sustainable supply chain management (SSCM). To increase the efficacy of SSCM implementation, 28 enablers were discovered and classified utilizing a thorough literature review. The authors built a methodology to examine the SSCM using the AHP in an effort to pinpoint the drivers and enablers.

The sustainability of the whole fresh food supply chain is significantly impacted by the production, processing, transportation, and consumption of food. There aren't many strategies and methods for qualitatively analyzing the dynamic driving forces behind sustainable supply-chain management for fresh foods (SSCM). This article first organizes the drivers, dimensions,

and particular effect indicators of fresh food SSCM found in the literature in order to address this issue. The internal strength, exterior connection, and comprehensive impact degree are then revealed by integrating rough set theory and decision laboratory analysis, while the prominence and relation of the driving elements are examined to show their importance. The findings indicate that the key driving forces behind SSCM are strategic, food security, and supply chain competition. Green technology, green product design, and green logistics should all be taken into consideration. It is necessary to enhance the production and distribution of added value as well as the management of food security [8]. The purpose of this study is to examine the connection between a sustainable supply chain and firms' financial performance (FP) and to provide actual data supporting that relationship. The significance of this connection is still up for debate. Design/methodology/approach: Granger causality tests are conducted on a large, diversified sample of 3,900 organizations over an eight-year period using multivariate measures of sustainable supply chain performance and businesses' financial success (2004-2011). Results show a broad bidirectional causal relationship between businesses' profit margins and revenue and the success of their sustainable supply chains. However, there is a one-way relationship between a company's profitability and the success of its sustainable supply chain. Additionally, this connection between the analyzed constructions was disrupted by the current financial crisis. Finally, when the entire sample is divided into various geographic regions and economic sectors in accordance with the Global Industry Classification Standard system, a broad diversity in relationship patterns between sustainable supply chain performance and companies' financial performance (FP) emerges. Practical implications: This study offers suggestions for enhancing a number of procedures, including manager assessment of environmental policy effects and stakeholder evaluation of business performance in sustainable supply chains around the globe. Originality/Value: Building on the mostly qualitative literature on the performance of sustainable supply chains and corporate financial success, this study offers quantitative proof of the discrepancies between these notions. This study adds to the dialogue on supply chain management, environmental policies, and the factors that influence a company's financial and environmental performance [9].

With regard to the unique internal and relational resources of the firm, the goal of this paper is to identify a common set of drivers of green supply chain management (GSCM), which affects the sustainable competitive advantages of firms in supply chains, and to classify these drivers into agreed-upon categories. Two strategic management theories of competitive advantage—resource-based and relational views—were used to identify drivers in this article based on a literature review. Following a study of the literature, three groups of resource-based drivers were recognized. Then, in order to achieve group agreement on the classifications, the Q-sort approach was used to arrange these drivers into groups based on the views of the experts. In order to priorities these drivers in future research, the findings of this study will be utilised to create a theoretical framework and a hierarchical decision-making model.

Moving toward sustainability is a crucial topic now owing to the population boom, environmental deterioration, and social inequality. In addition to its relevance, focusing on sustainability gives businesses the chance to be inventive. Prior research mostly focused on pinpointing factors that improve a firm's potential to create new goods and services. However, sustainability orientation as a direct driver of a firm's innovativeness leading to long-term commercial success has received less attention. In this research, the performance of the firms and the drivers of a sustainable supply chain have been assessed. Additionally, it has been studied

how the mediating notions of corporate social responsibility and corporate environmental management affect the link between strategic sustainability orientation and business performance. The findings show that managerial attitude and employee motivation have positive effects on strategic sustainability orientation, while corporate environmental management and corporate social responsibility play a mediating role. Strategic sustainability orientation also has a positive impact on firm performance. Using the SEM approach, this research was done on 120 Iranian businesses involved in the food industry.

DISCUSSION

The idea of sustainability is wide, and it has become more popular as the effects of pollution, climate change, and economic inequality have come to light. It compelled people, businesses, and governmental organisations to reconsider old habits and take into account how "business as usual" impacts people and the environment. Sustainability compels us to change for the sake of longevity by forcing us to see our impact on society and environment more holistically. Sustainability in the supply chain is no different. Businesses must assess the effects of their supply chains on the environment and people while still producing profitable products. Can both of these coexist at once? Can a business be successful and ethical in both the social and environmental spheres? This article examines the rising need for environmentally friendly supply chains, industry sustainability trends, and how visibility technology is assisting businesses in achieving their environmental objectives.

Sustainability in the supply chain: Sustainability in the supply chain refers to a deliberate business commitment to fair labour standards and environmental protection at every stage of the supply chain. It is a bottom-up strategy that seeks to link socially conscious and environmentally conscious activities with conventional supply chain objectives of speed, dependability, optimization, and continual improvement. Although it may seem like a lot of jargon, sustainability is a subject that is becoming more and more crucial to the industry since it eventually leads to financial and operational savings while promoting the lifetime of businesses.

Three components are essential to a sustainable supply chain: Protection of the environment against damage brought on by both direct and indirect supply chain operations such as manufacturing, warehousing, packing, and shipping. This is the aspect of supply chain sustainability that is the easiest to identify and it covers issues like waste, emissions, water treatment, and deforestation.

Social Responsibility: How people are treated inside a company's supply chain is determined by its guiding principles, ethics, and morality. This holds true for reasonable pay and secure working conditions for all suppliers and supply chain tiers. The effect of the company on the neighborhoods where it works is also taken into consideration.

Economic responsibility refers to the financial duties and demands placed on partners, workers, owners, and the local communities where the supply chain is located. This includes goals to reduce risk and preserve earnings while upholding commitments to environmental and social responsibility.To assist businesses optimise every step of a product's journey, from sourcing to distribution, sustainable supply chain management requires a mix of procedures, regulations, and technology. Although it may seem like a difficult endeavour, sustainability is quickly gaining popularity as a non-financial success measure and a generator of customer trust in a company.

Sustainable Supply Chain Practices in Demand: The global supply chain has been under more attention recently because to the expanding debates around corporate accountability, human rights, and climate change. Demand for sustainable supply chains is primarily driven by consumer demand, investment pressure, and international legislative agendas.

Demand from New Consumers: Consumers are becoming more and more conscious of the origins, materials, and manufacturing processes of the goods they purchase. More consumers are thinking about how their purchasing decisions affect society as a whole and are looking for eco-friendly, zero-waste goods and companies that share their beliefs. Beyond just changing brands to promote sustainable practises, more customers are blatantly and actively boycotting businesses that do not uphold ethical labour or environmental standards. In the era of social media, boycotts and rumours of unethical behaviour swiftly spread and may significantly harm a company's earnings and image.

Demands for sustainable practises from investors: Investor demand is rising along with customer demand for sustainable supply chain methods. A growing number of investors are taking into account the environmental, social, and corporate governance (ESG) aspects of their investments, as seen by the emergence of sustainable investing, also known as socially responsible investing or ESG investing. Sustainable investment based judgements on a company's social capital and commitment to good change in addition to its financial success. As more millennials join the investment market over the next several years, ESG investing is projected to increase, which will make supply chain sustainability more crucial for businesses.

Planetary eco agendas: The majority of nations have set targets for being carbon neutral in the next 30 years. There are other issues on the agenda as well, but the majority of this focuses on greenhouse gas emissions in logistics, manufacturing, and agricultural operations. The sustainability of the supply chain and global agendas are impacted by urgent challenges including single-use plastic, unnecessary packaging, child labour, and unsafe working conditions.

Initiatives for Internal Sustainability: Consumer expectations and governmental reforms are two obvious external drivers of supply chain sustainability, but internal considerations also encourage businesses to adopt better sustainability practises. A corporation gains from sustainable supply chain management activities in a variety of ways, including the following:

Continuous supply chain optimization via continual sustainability assessment

Enhanced corporate collaboration via joint projects

Fostering a collaborative workplace via shared objectives and ambitions

Better risk reduction and emergency preparedness for the supply chain

Enhanced client emotion and brand impression

Sustainability in the supply chain has real advantages for society, the environment, and enterprises in addition to being a trendy term or marketing gimmick.

Trends in Sustainable Supply Chains: Supply chain sustainability is as complicated as the supply chain itself and is not a straightforward objective that can be accomplished by a predetermined set of procedures. Companies who are devoted to sustainability should take these factors into

account when evaluating their supply chains and undertaking ongoing supply chain improvement projects. Sustainable supply chain trends will include on adaptability and resilience, reducing carbon emissions throughout the supply chain, and employing technology to improve transparency.

Increasing supply chain resilience: Even the biggest, best-equipped businesses were unable to escape the effects of COVID-19's severe disruption of the global supply chain. Lockdowns in regions with a high concentration of industrial facilities, the suspension of ocean freight, and an unanticipated rise in consumer demand for completed goods all contributed to supply chain disruption and spiking freight charges. A supply chain that had been operating rather well for decades found itself in chaos all of a sudden, underscoring the brittleness and volatility of the global network. We can now see that the whole supply chain is in danger from unforeseen external variables like a global health emergency or severe weather. More businesses are making an effort to make their supply chains resilient and agile in light of this fact. The most sustainable supply chain techniques to boost resilience include supplier diversity, nearshoring, and effective risk management.

Scope 3 Carbon Emission Reduction: As a result of worries about climate change, greenhouse gas (GHG) emissions, also known as carbon (CO2) emissions, have been a hot subject in supply chain sustainability for years. The majority of businesses have already taken action to cut emissions from their buildings and activities (Scope 1) and the energy they buy (Scope 2), both of which are within their easy control. Most people have not yet addressed Scope 3, which is defined as "the indirect emissions that occur in the reporting company's value chain, encompassing both upstream and downstream." Up to 80% of a company's overall emissions fall under Scope 3, which also includes CO2 emissions from partners in transportation and distribution as well as waste production. It might be difficult to fully comprehend the effects of Scope 3 emissions and calls for significant insight into vendor and provider operations. To successfully minimise Scope 3 emissions, a company's partner network must be engaged and committed to sustainable supply chain practises.

Technology Can Increase Transparency: One of the largest trends nowadays and maybe the most important element of sustainable supply chain management is transparency. Supply chain visibility is the starting point for transparency, but how a business utilises visibility insights to act and better manage risks defines transparency. Understanding both the upstream operations of suppliers and manufacturers as well as the downstream effects of distribution and consumer interaction is necessary. Transparency offers information to strengthen the resilience of the supply chain and direct sustainable supply chain operations to solve problems like waste and emissions.

The ability of businesses to display data from internal and external sources for a comprehensive perspective of supply chain players and risks is key to transparency. The creation of digital twins, which serve as virtual representations of an organization's supply chain, is the primary method used to get this information. With the help of digital twins, it is possible to map suppliers, the sources of materials, warehouses, and logistics in real-time, monitor supply chain dynamics, and spot potential sustainability issues. With the use of digital twins, businesses may anticipate future challenges, respond to disruptions swiftly, and locate vendors or other suppliers that don't support the organization's long-term objectives. Initiatives for long-term sustainability and supply chain resilience are informed by this technology.

Creation of an Eco-Friendly Supply Chain: A contemporary company's success depends on creating a sustainable supply chain, and these four measures may help.

Identify sustainability issues: Technology and historical data may reveal supply chain pipeline flaws and point out risky regions. The influence of each phase and each partner on environmental, financial, and social responsibilities should be assessed.

Implement circular supply chain strategies: The concept of "once is never enough" is embraced by the circular supply chain, which looks for ways to recycle things and utilise them again in production. Reducing supply chain waste may be accomplished effectively and practically by striking a balance where inputs and outputs are equal.

Talk about CO2 emissions and fuel use: For businesses devoted to supply chain sustainability, reducing CO2 emissions and fuel use makes sense. For this sector to be improved, empty miles, route planning, reverse logistics, and final-mile data are essential.

Engage vendors: At every stage of the supply chain, visibility and involvement are necessary for sustainable supply chain management. Engaging suppliers with sustainability toolkits and established codes of behaviour helps in setting expectations, while regular audits and assessments increase accountability and promote long-term change.

Supply Chain Sustainability is Supported by Real-Time Shipment Visibility: Visibility is the first step to supply chain sustainability. Since the supply chain has an influence on environmental, social, and economic indicators, it is difficult to create sustainability targets without a thorough knowledge of this impact. Finding less evident problems becomes critical for sustaining momentum and making continuing changes when businesses make progress toward sustainability in the more prominent areas of their supply chains. Data on in-transit goods is available thanks to real-time location and condition visibility, which supports sustainable supply chain operations.

The fulfilment of outgoing client orders or the receipt of incoming purchase orders to restock materials and inventory are two examples of why supply chain teams find real-time shipment monitoring to be crucial. However, there is more that shipment monitoring may provide in terms of insight into sustainability measures. As supply chains become more transparent and carbon emissions are reduced, real-time insight into shipment location and condition gives useful information.

Making the Supply Chain More Transparent: Transparency in the supply chain necessitates knowledge of the procedures followed by distributors and upstream suppliers. Shipment visibility in real-time provides information on both. A business may assess the transportation effectiveness and environmental standards of supplier shipments to make sure that upstream partners are adhering to sustainability objectives. In addition to giving clients the information they need to conduct their operations successfully, downstream cargo visibility delivers insight into direct carbon emissions (more on that in a minute). Real-time location monitoring helps maintain activities for the environment and the economy both upstream and downstream.

On numerous levels of the supply chain, real-time shipment location monitoring is crucial for achieving environmental objectives and reducing Scope 3 carbon emissions. Supply chain sustainability is supported by shipment tracking technology, which gives information on important parameters like:

Heavy-duty vehicles are responsible for 57% of the carbon emissions in the logistics sector, although they idle for approximately 40% of their miles driven. Each level of sustainability has issues as a result of this mismatch. Socially, truck drivers are unhappy since they aren't compensated for the kilometres they travel that aren't carrying cargo. In terms of money, shippers pay more for freight as drivers try to make up for empty-mile revenue lost. Environmentally speaking, deadhead miles and ineffective load planning lead to an increase in carbon emissions. The use of shipment visibility technologies to discover round-trip possibilities inside a company's network helps reduce wasteful empty miles. As a result, vehicles travel fewer empty miles and have pre-planned reloads nearby, which helps businesses manage expenses and reduce harmful greenhouse gas emissions.

Stay Periods: Although detention and dwell times may not seem to be directly related to the sustainability of the supply chain, they eventually affect revenue and carbon emissions. Detention fees are costly and ineffective from a financial standpoint for shippers, who pay $50 to $100 per hour to drivers who are kept longer than the typical two hours for loading or unloading. Environmentally speaking, idle vehicles in harsh conditions or refrigerated trailers transporting goods that need to be kept at certain temperatures demand fuel and hence raise carbon emissions while in motion. Real-time cargo visibility enables businesses to see supply-chain bottlenecks, such as warehouses and facilities with protracted dwell periods. With the use of this information, problems may be resolved while lowering the costs and negative effects on the environment of prolonged detention and stay durations.

Several important factors have contributed to the trend of integrating sustainability into supply chains. The primary drivers and discovered that the supply chain and the movement toward being green are related. Environmental, cost-reduction, economic, and intangible consequences are the four possible results of this adoption. Some internal and external forces are the sources of drivers, which are defined as motivators bringing sustainability into supply chain processes. Customers, the government, the media, investors, and suppliers are the ones putting pressure on businesses to incorporate green supply chain practices into their operations. It is obvious that developing a sustainable environment is not the only motivation for businesses to adopt the new sustainable supply chain trend. In order to maintain their social wellness, companies are taking a number of hidden signs into account.Importance of Sustainable Supply Chain Management Organizations are encouraged to implement sustainable supply chain efforts by both internal and external influences (such as the government, community, investors, consumers, suppliers, and workers). Pressures, triggers, facilitators, and drivers are all terms used interchangeably in the literature to describe these impacting elements. Drivers of SSCM are characterized as forces that compel companies to execute certain sustainability efforts. Drivers of SSCM are "external elements that begin and encourage focus organizations in adopting SSCM practices," Therefore, "motivators or influencers that encourage or push firms to embrace sustainability efforts across the supply chain" may be used to identify drivers for SSCM in this context. However, the impact of various forces on supply chain choices varies[10]. For instance, stockholders have greater influence on logistics-related supply chain choices than do shareholders and the media. Similar to this, regulatory agencies have greater effect in the TBL's environmental component than workers or non-governmental organizations (NGOs) have in the social dimension. The overall topic in the research is how enterprises may better ensure their social fitness and legitimacy by adhering to the laws and norms within their operational environment by using institutional theory to describe how drivers of SSCM impact choices about sustainable activities.

CONCLUSION

It is essential for business to include sustainable practices into supply chain systems in order to protect the environment. The implementation of sustainable supply chain management is seen as a business problem for enterprises. This implementation is facing various challenges due to a variety of variables. However, there are still additional elements that are motivating the implementation of supply chain sustainability. To enter the field of sustainability, it is essential to have a thorough awareness of the problem.

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CHAPTER 22

WAREHOUSE PERFORMANCE AND STORAGE ISSUES IN SUPPLY CHAIN MANAGEMENT

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Abstract:

Warehousing is the practice of keeping products in a secure location before preparing them for delivery. When large quantities of products arrive, warehouses inventory them, keep track of where they are in the building, and determine how long they need to be held. Supply chains are under more pressure than ever to complete orders quickly, and warehouse logistics may assist. In certain situations, the order fulfilment process is completed extremely fast, while in others, long-term storage is done in warehouses. Usually, things are kept in warehouses until an online purchase is made, at which point they are dispatched straight to the buyer. In conventional retail, long-term inventory storage is more typical.

Keywords:

Inventory, Performance, Storage, Supply Chain Management, Warehouse

INTRODUCTION

Facilities for warehousing are essential to the operation of the supply chain as a whole. The fundamentals that warehouses must understand in order to be efficient and successful in supply chains will be covered in this study, along with some insight into present problems and potential solutions. The strategies, duties, and responsibilities for warehouses are clearly shifting as a result of ongoing globalization and changes/challenges in areas like reverse logistics, environmental sustainability, information technology, and overall supply chain integration. The term "distribution center" (DC) may really be far more apt in describing the wide variety of operations that currently take place in contemporary warehouses, going beyond just processing client orders to provide an ever-growing assortment of services. Warehouses play a significant role in the distribution of commodities throughout the whole supply chain, from raw materials and work in progress to completed items. It is an essential component of the supply chain network in which it works, and as a result, its tasks and goals should be in line with those of the supply chain. It is not a "Standalone" aspect of activity, and the supply chain network as a whole cannot have any weak links. The research's central question is whether it is possible to optimize warehouse operations by altering material flow and space use. The impact of the adjustment on the company's financial performance is also taken into account.

Supply chain management that is effective and efficient has a beneficial effect on organizational profitability. A rival method of product flow from the procurement of raw materials to customer satisfaction is supply chain management. The goal of supply chain management is to increase activities that create value for customers while decreasing procedures that bring no value to the firm. By integrating supply chain management, some businesses have achieved tremendous financial success. The term "supply chain management" refers to a range of activities including sourcing, operations, and logistics. Most firms don't have a dedicated supply chain management department, but in reality, every company practices these tasks. Enhancing product flow is a top priority for good businesses. The industry can safeguard high product availability and profitability by maintaining high product velocity.

A crucial component of supply chain management is warehousing management. Logistics and warehouse management deal with the supply chain's downstream segment, or the movement of the product from manufacturing to consumer delivery. Fast and inexpensive product delivery is one of warehouse management's key goals. The administration of warehouses performs a variety of tasks, such as receiving products, correctly stacking them, documenting them, and dispatching them. All company sizes, whether big, small, or medium-sized, use warehousing, but the focus is on effective warehousing[1]–[3]. All firms in Pakistan utilise warehouse management, although the methods used vary according on the kind of goods, organizational wealth, organizational size, type of company, client expectations, etc. The goal is the same everywhere in the world: to provide the greatest customer service with the fewest resources. However, practises and functions of warehousing may vary. All supply chain participants, including vendors, businesses, distributors, and retailers, have various sizes of warehouses. Because each SKU has a unique purpose or flavour, these warehouses are in charge of handling all stock keeping units (SKU) in a unique way. There are two different kinds of warehouses: one is for raw materials, and the other is for completed items. Businesses that are based in manufacturing have both sorts of warehouses, but businesses that are based in services only operate with completed products warehouses. Both kinds of warehouses do the same basic warehousing tasks, but the nature of SKUs and clients. Although there is a wealth of scholarly research on warehouse management, there is still need for investigation in the context of Pakistan. In Pakistan, the fast-moving consumer goods (FMCG) sector is quite young. Products relating to groceries, food, beverages, biscuits, and confections move quickly.

Businesses that wish to provide excellent customer service must prioritise effective supply chain management (SCM) on a strategic level. SCM refers to an organization's attempt, in collaboration with its partners, to design and effectively manage a supply chain process. The flow of a product from production to the hands of the end customer is expedited with good SCM, aiding organisations in gaining a lasting edge in today's fiercely competitive business environment. Warehousing, which simplifies product sorting and maintains product security, is a crucial component of SCM. There are additional advantages of effective warehousing in SCM that are less evident or often ignored, despite the fact that some people may think of a warehouse as only a location to store completed items. Contrary to popular belief, warehousing plays a bigger part in the supply chain process. Continue reading to discover more about the value of effective storage.

Helps to ensure effective inventory management overall: Keeping track of your inventory is essential to good SCM. Large inventory management might be considerably simpler and quicker for organisations with a good warehouse. Lack of this might result in sluggish order processing

and late shipping, which would be bad for the customer experience. Inefficient inventory management may also increase the chance of stock damage or spoiling. You may create a systematic method for accepting orders and distributing goods since a warehouse may serve as a central place for all of your items. You'll be happy to know that you can hoist small, medium, or heavy loads in your warehouse thanks to the aerial work platforms that are available for purchase on the market. It significantly boosts the effectiveness of the inventory management procedure. Indeed, storage is perfect for companies looking to improve their organisation and balance supply and demand. Having effective inventory management in your supply chain has the following benefits:

Tracking surplus items: With better product identification, classification, and storage, you can manage extra goods and send them to areas with greater client demand. Stock protection: Effective warehousing enables companies to store items with low demand safely until they are needed. Effective inventory management as part of SCM may strengthen the supply chain.

Increases the value of the logistics system: Another reason why effective warehousing is crucial to SCM is that it gives companies a way to guarantee that the appropriate items will be available at the proper time and location. In this approach, the commodities' utility value is increased. For any additional tasks that need to be completed, such as order consolidation, component assembly, product mixing, and cross-docking, the warehouse is available and always prepared. Even the packaging and shipping phases of the logistics system depend on it greatly. In supply chain management, the main goals of a logistic system are to speed up processes and save costs. Proper product management in the warehouse might help with this.

Ensures Client Contentment: Owners of businesses understand how crucial it is to guarantee consumer pleasure by giving them a positive shopping experience. Effective warehousing may make it feasible. After placing an order, customers expect to be informed of an anticipated delivery date for their items. Their trust is increased by knowing when their order will be delivered. Some of them as a consequence pay quicker. Of course, customers become more reticent when there is doubt about the promptness of goods delivery. Nowadays, it seems that shoppers take delivery time into account while selecting a product and determining whether or not to go on and make the purchase. Fortunately, a warehouse might assist reduce product delivery faults, allowing for quick and secure delivery of items for company owners that have solid warehousing practices in their entire SCM strategy.Provides economic advantages: The many documented economic advantages that come with creating a warehouse are a strong justification for making the investment. The storage capacity of the warehouse and how it acts as a hub for your items, in addition to the supply chain's increased efficiency, all contribute to the warehouse's economic benefits. Effective warehousing might save expenses associated with shipping, outbound product delivery, and the movement of products. Through activities of accumulation and consolidation, these items could be seen or realized. Here's a deeper look at how cost-saving strategies like consolidation and accumulation could work: Consolidation procedures allow things to be supplied to your warehouse as stocks, eliminating the need to send them separately from various sources. You or your employees may pack and send the item out once an order is made. You might balance the supply and demand of stocks through accumulation activities. As you are aware, supply and demand may significantly affect your company's profitability, particularly when a product isn't always readily accessible in the market despite there being a year-round need for it. It is referred to as safety stocking and serves as a kind of inventory insurance.

LITERATURE REVIEW

Nor Wazirah Radzman Shah *et al*. [4] Supply Chain Management benefits from the growth of the Halal business in Malaysia. As a crucial component of the supply chain process, logistics operations play a key role. Manufacturers/suppliers, modes of transportation, storage/warehouse, customers/clients, and third-party logistics (3PL), also known as logistics service providers, are among the industry participants that participated in logistics operations (LSP). This research aims to examine the implementation of halal transportation services, particularly for Malaysia's halal food business. Monitoring Halal performance in transportation operations that need to adhere to Shariah principles is one of the components of managing "Halal" in logistics activities, claims the Halal Industry Development Corporation (HDC, 2009). In order to remain competitive in the expanding business market, industry participants must comprehend the expertise and associated challenges relevant to the Halal supply chain. Although Malaysia has all the infrastructure required to support the expansion of the halal sector, this is where the worry resides.

K. Sankar *et al*. [5] Organizations must continually adapt to consumer demand, vendor compliance measures, and multi-channel difficulties in order to obtain a competitive edge over the growing competition. A coordinated warehouse operation may make the most of the company's space while enhancing facility management and staff productivity. When the last time the organization’s warehouse operations was were given a strategic, objective perspective? Solutions for warehouse management make it possible to coordinate commodities and operations in real time. The process of strategically managing the acquisition, transfer, and storage of components, completed goods, information, and materials is known as logistics management. Customer Relationship Management is aided by e-logistics. Consolidation Aids in Order Scheduling, Tracking, Inventory Fulfillment, and Invoicing. Logistics Planning Provides Seamless Supply Chain Integration E-Logistics in Increasing Production Capacity Web-based system that provides exception notification and in-transit visibility Services for warehouses, storage, and distribution Inventory Control Improves, upgrades Order Fulfillment Pick, Pack, and Ship Procedures View automatically updated route schedules to determine if a motorist is ahead of or behind schedule.

Anton Radaev *et al*. [6] Determining the features of transport and storage operations in densely populated locations is the most prevalent issue among a wide range of design and performance management issues for industrial firms supply chain networks. The placement of the warehouses and the characteristics of the related material flows are significantly influenced by the divergence of the logistic structure development in the region. The features of the transportation and warehousing networks in a significant urban area and its surroundings are discussed in this article. This refers specifically to the warehouse location and delivery lot sizes. Based on a collection of mathematical models, the article proposes a method for resolving this issue by using linear and non-linear optimization through commonplace computer programmes like Microsoft Excel, Mathcad, MatLab, etc.

Charles G. Petersen [7] Order picking, a crucial step in the supply chain and the main expense of warehousing, is the process by which a number of items are pulled from a warehouse system to fulfil a number of client orders. The crucial concern is to boost order picking activity speed while concurrently lowering cost. This study's main goals are to evaluate different routing heuristics and an ideal routine in a volume-based and random storage environment, compare the

performance of volume-based storage to random storage, and look at the effects of travel speed and picking rates on routing and storage policy performance. The experimental findings demonstrate that the trip speed and picking rate, storage strategy, and pick list size have a significant impact on the solution gap between routing heuristics and optimum routing. Additionally, volume-based storage outperformed random storage in terms of cost savings, although once again, these savings are reliant on the picking rate and trip speed.

Francesco Boenzi *et al.* [8] One of the most important problems in operation management is warehouse management. Many businesses are automating their fundamental warehouse tasks to save money in today's cutthroat marketplace. However, 75% of all installations still use conventional mechanised warehousing systems (MWS). Forklifts are used in MWS to handle loads. Adopting effective "internal logistic techniques" may aid in cutting the time and expense associated with warehousing operations. Many businesses have embraced green supply chain practises (GSCP) recently in order to improve their environmental performance and meet financial objectives (Wu et al., 2015). Additionally, as they significantly aid in the sustainable growth of contemporary cities, warehousing at port or railroad station storage facilities is gaining considerable attention in the design of Smart City logistics. According to this viewpoint, it is necessary to establish an ideal "internal logistic plan" that allows for the combined minimization of costs and environmental effects of warehousing operations. To address the storage location assignment issue (SLAP) and improve the environmental performance of internal logistic operations in a warehouse, the goal of this research is to create a nonlinear integer programming model. The kind of forklifts used (internal combustion or electric engine fitted), as well as the sizes and weights of the items to be handled, are used to determine the most appropriate storage solutions.

Donald Waters [9] Effective warehousing still has a significant impact on a company's bottom line, despite the just-in-time manufacturing approach that seeks to do away with warehouses and the expenses associated with keeping inventory. Modern state-of-the-art technologies, measures, and procedures are covered in "World-Class Warehouse and Material Handling" for drastically raising the efficiency, accuracy, and general productivity of warehousing operations. This thorough book, written by one of today's acknowledged logistics thinking leaders, offers reliable answers to questions like: The seven tenets of top-notch warehousing Profiling of warehouse activities measurements of warehouse performance Computerization and automation in the warehouse Taking in and putting away Operation of storage and retrieval selection and packaging Making warehousing operations more human The book "World-Class Warehouse and Material Handling" covers the methods and procedures needed to satisfy the shifting warehousing requirements. All logistics professionals will benefit from its wealth of tried-and-true and cutting-edge techniques for enhancing the output, standard, and turnaround time of their current warehouse operations. Effective warehousing used to be a pretty simple process of receiving, storing, and delivering. But storage is more complicated than it has ever been, not to mention more expensive, in the modern era of e-commerce, supply chain integration, globalization, and just-in-time technique. World-Class Warehousing and Material Handling describes the warehousing concepts necessary for the execution of world-class warehousing operations while cutting through the complex variety of warehouse technologies, jargon, and third-party suppliers. It is the first widely-published technique for warehouse issue resolution across "all" sections of the supply chain, holding up efficiency and accuracy as the keys to success in warehousing. It offers an organized set of principles that may be utilized to simplify

all forms of warehousing operations. Case studies from companies like Avon, Ford, Xerox, True Value Hardware, and others show how today's most creative supply chain and logistics managers are coming up with tried-and-true answers to a range of warehouse problems. The subjects covered include: Using warehouse activity profiling, you may find the reasons behind issues with information and material flow as well as potential areas for development. Measures of warehouse performance for tracking, reporting, and comparing warehouse performance To increase storage density, handling productivity, and make trade-offs with the needed capital expenditure, storage and retrieval system selection is necessary. Order choosing tactics to increase efficiency and precision of order fulfilment Computerizing warehouse operations to monitor performance, profile activities, and streamline processes When discussing customization, information technology, performance analysis, expansion and contraction planning, and the overall function of the warehouse in logistics management and the supply chain, "World-Class Warehousing and Material Handling" incorporates global and e-commerce topics. It will help managers create a warehouse master plan that is intended to lessen the consequences of supply chain inefficiencies, increase logistics accuracy and inventory management, and lower overall warehousing costs. It is packed with tried-and-true operational solutions.

DISCUSSION

The goal of warehouse management is to ensure that all of the procedures that take place there operate as smoothly and effectively as possible. Every warehouse activity is subject to errors and difficulties, even if some of these procedures are automated and seem to be error-free. The cost of global storage is estimated to be over £300 billion annually, according to a McKinsey & Company analysis from 2019. Additionally, the expense of fixing errors and inaccuracies is not included in that sum. The speed, efficiency, and productivity of a specific warehouse activity as well as the full network of related procedures may all be impacted by warehouse issues. Most often, these mistakes aren't discovered until after the procedure has started, or even after it has ended. It's often too late to correct the mistake at that point, and it can even be too late to lessen the harm that has been done. However, if you are aware of the various problems that could arise in your warehouse operation, you can anticipate them and prevent harm from happening in the first place. In this post, we'll talk about some of the most frequent issues with warehouse management and how to avoid them.

Accidental job loss: In most warehouses, each item is subjected to a number of activities, which are then connected to form workflows. However, if a process is poorly managed, you can discover that the same task is being unintentionally carried out more than once. When you have to go back and fix the error, these redundancies drive up your labour expenses and consume more time. Since there is more room and goods to manage in larger warehouses than in smaller ones, this occurs more often in the latter.

Order picking: the process of selecting items from their storage locations in a warehouse to fill an order—is where redundancy is often seen. Order picking is often a one-person activity in smaller warehouses, where there is minimal tolerance for mistake. However, in a bigger warehouse, many individuals collaborate to choose items from various locations in the warehouse in order to fulfil a single request. Multiple employees handling the same order increases the likelihood of errors like selecting an excessive number of the same items. A remedy is to spend money on technology, such as a contemporary warehouse execution system (WES), which will assist you in automating the redundant procedures in your warehouse. For instance,

you might utilise barcode technology to scan the items that have been selected for the order and have the system alert the user of any duplicates to assist decrease redundancy in order selecting.

Unkempt warehouse design: Rising storage costs over time have forced warehouse managers to use their warehouse space more effectively. But according to a report by Logistics Management from 2018, just around 68% of manufacturers' average storage capacity was really being used. Inefficient use of space results in a lack of storage, which is still a widespread problem in warehouses. This issue may be resolved by creating an ideal warehouse plan. This entails using the floor space and vertical space to the fullest while yet allowing adequate space for warehouse workers to walk through. It also include researching methods to employ machinery and automation to cut down on labour and labour expenses, enhancing warehouse product accessibility, systematizing inventory classification, and making sure that stock is kept securely.

To begin making the most use of your warehouse space: the technologies, such as a warehouse management system, that may assist you in organizing the layout of your warehouse (WMS). If you provide certain WMSs the measurements and dimensions of your warehouse and goods, they may be able to provide you with a 3D model of the ideal layout. Another option is to think about a network of several computer-controlled pieces of equipment called an automated storage and retrieval system (AS/RS), which automates your picking and put away procedures. An AS/RS may save a substantial amount of otherwise unused warehouse floor space in addition to enhancing the speed and efficiency of your activities. You may always start off simply instead of upgrading your technology if you're not ready. To determine which goods in your inventory sell the most quickly, use your current system for controlling your inventory and sales. In order for them to be picked up and put away more quickly, make sure you are keeping those goods in the areas that are the easiest to reach.

Poor inventory control: Understanding that something is really put someplace else after expecting to find it somewhere else accepting a purchase order under the impression that you have enough inventory to complete it and then discovering that you don't. Your order lead time will now be much longer since you must place a backorder. Denying a request after determining that you do, in fact, have enough stock to complete it. Attempting to store stuff you've acquired but are having problems figuring out where to put it. Any of these issues might be a sign that you haven't been keeping accurate records of your inventory and constantly updating them. 43% of small firms, according to a report by Wasp Barcode Technologies, either don't maintain inventory or do so manually. Another Peoplevox poll revealed that 34% of companies had put off shipment because the ordered items were not genuinely available. Manual inventory checking procedures give a lot of space for human error, which makes errors very easy to occur. They may sometimes occur while utilising obsolete software. Changing to a newer solution is one method to solve these warehousing problems. This might either be an inventory management-specific system or a general warehouse management programme with real-time inventory management functionality. A typical system begins by gathering your inventory data using a fixed or portable device, such a barcode scanner. Your software solution uses this data to categorise and keep track of your inventory after which.

Warehousing's function in supply chain management: One of the most important yet least understood parts of the supply chain process is warehousing. The effectiveness and convenience of your whole production and distribution strategy may be increased with the right warehouse. Operations for warehouses, inventory management, and distribution that are properly thought out

may increase efficiency while reducing costs. Warehousing could be a needless investment for online merchants that are just getting started that won't provide much of a return. However, there are several advantages to storage for both your business and the whole supply chain.

Warehousing: Warehouses are designated storage spaces with a variety of locations that make it simple for sellers to transport goods to buyers. Orders might come from anywhere in the nation in this day and age when online purchasing is the norm. Reaching the clients might be difficult in such circumstances. Here is where the sellers may benefit from the warehouses.

A warehouse could be a distinct entity for certain businesses. A modest Instagram vendor will utilize their room as a place to store their goods. A warehouse, for instance, may be a 16000 square foot structure that houses items for manufacturing or SME businesses. To maintain the needs of product delivery in sync, a warehouse has a variety of components including storage racks and bins, temperature control systems, warehouse management software, and inventory management systems. Picking up tools to move products from one place to another is also included. In contrast to a warehouse, a distribution centre also handles picking, packing, shipping, and storage. However, almost all warehouses nowadays are built with distribution centre functions. Because of these interlocking objectives, storage has become a crucial step in the supply chain management process. The ecommerce supply management process includes planning, information gathering, product sourcing, inventory management, transportation & shipping, and returns of items.

Warehousing's significance in supply chain management: Commodities must be stored if a supply chain is to be efficient and smooth. In warehouses, raw materials, semi-finished products, and completed items are kept and organised. In other words, your whole company strategy should give high importance to storage. Suppliers may either own and operate their own warehouses or utilise a third party warehouse to store and distribute their products. There are two different types of warehouses, and whatever one you choose will affect how it operates in your supply chain: General warehouses keep your belongings safe and secure for as long it takes you to require them. These warehouses are generally used by businesses to store large amounts of backup inventory or seasonal items. They often only provide minimal handling and transportation services. Distribution warehouses provide a wider variety of services, such as order fulfilment, handling, short-term storage and transportation, and distribution. In the supply chain, warehouses play a special role in managing each stage of the process from receiving a product from a supplier to delivering it to a retailer or customer. There are several benefits to using storage in your supply chain operation. Here are a few illustrations:

Control of Inventory: Inventory management and tracking are easy and uncomplicated when raw materials and goods are kept in a warehouse. You can guarantee that you always have enough supply to meet demand by placing semi-finished or completed items in storage, which enables you to better manage your production levels. You may get a centralized inventory tracking system from a well-run warehouse. You'll be able to manage any incoming orders more swiftly and store, package, and distribute goods more effectively. Your business may benefit from producing on time and on a budget by using effective inventory management and a clever storage plan! With such a system in place, you can thus continually keep an eye on your inventory, restock when supplies are low, and keep track of the SKUs you have in the warehouse. Utilizing specialist inventory management software will enhance this procedure. You can simply keep track of your belongings if you store them all in one place.

Growth Possibilities: By contracting with a warehouse to handle your storage and delivery, you may store anything you don't need right away off-site. This eliminates the need for you to worry about keeping all of your finished items and raw materials at your manufacturing facility. Your inventory may increase as your company grows, which would need more buying space.

Enhanced Profits: Your operational costs may be reduced, and your profitability can be increased, by employing warehousing to combine storage and delivery in one location. The need for fewer workers, less sophisticated machinery, and fewer structures results in cheaper utility and transportation expenses. Your operations will run more smoothly if you choose the right warehouse, which offers flexible short- and long-term storage. Additionally, it will make inventory data easier to manage and will aid in properly and quickly processing orders. By saving you time and money, these services enable you to concentrate on your strong points.

Lowering of risk: Inventory that is lost in warehouses is one of the most challenging issues. It is inevitable that some goods may be lost, damaged, or improperly accounted for while the space is being moved and organized. Sadly, this may result in higher inventory costs per unit, which would increase the overall cost of products. Finally, price inflation affects the company's ability to compete. Additionally, it can make achieving 100% order fulfilment more challenging.

Inventory loss is less likely when your products are stored in a warehouse, which also transfers risk to the facility. A respectable warehouse should provide trustworthy, round-the-clock security to ensure that your products are stored securely. Pickrr has warehouses all around India, so you may rely on them for your storage and fulfilment requirements. This will also help you contact your target audience more effectively.

Order Pickup Done Quickly: Order selecting is a task that demands the highest level of precision. If done poorly, you run the chance of shipping the erroneous delivery to your customer, which might seriously harm your company. Additionally, if you deal with delicate goods, poor packing may result in damage to the products and greater losses. You must maintain excellent order in your inventory as a consequence. As a result, you won't have any problem locating them and picking them up at the specified spot. Mobile phones, for instance, are easily misled if you provide electrical items with equivalent specifications. You will damage your service as a consequence. Find a warehouse with strategically positioned racks and bins and automated software to help prevent such accidents.

Authentic Packaging: Next, tamper-proof packaging is essential if you want your supply chain to continue operating without incident. Without a warehouse, businesses often struggle to store adequate packaging for their goods. With a dedicated warehouse, you can choose storage zones for your packaging materials based on your SKUs and never pack a product incorrectly.

Your branding is greatly influenced by your packaging. It shapes the customer's first perception of your brand. Therefore, it must always be tamper-proof in order for the items to be delivered safely and unharmed to the customer. Additionally, shipping companies charge you depending on volumetric weight. This relates to the size of the package. With the warehouse set up and the packaging supplies accessible, you may choose the best packaging for each SKU, cutting down on shipping costs and weight variations.

Quick shipping: You can control all of your shipments from a single place by using a warehouse. Once your items are stored, selected, and packed in one location, there is far less chance for confusion, and you can immediately reduce the TAT for your first mile operations. Additionally, the location of your warehouse has a significant impact on how quickly orders are delivered. If your warehouse is near to the delivery location for your customer, you may ship the item promptly, save money on shipping, and prevent orders from being returned because of delayed deliveries. With a well-designed warehouse, you can easily optimise both first- and last-mile operations.

Stabilization of Prices: Depending on the time of year and where you are, you may acquire things in large quantities and sell them. If you sell clothing, for instance, you can decide to hold winter products in your warehouse and resale them the following season rather than discounting them and losing money. A price stabilization warehouse assists you in maintaining constant stock levels and maximizing profits by storing your items for a longer length of time. Frequently changing government regulations provide you the chance to rearrange your priorities. You'll be able to earn more money since you won't need to replenish your inventory as regularly.

Outstanding customer service: If your product is delivered on schedule, in tamper-evident packaging, and without extra charges, your client will be extremely delighted. As a consequence, if you operate a warehouse, you may increase customer satisfaction by optimizing your operations.

The delivery date of an order is something that almost all online vendors want to know. That cannot be obtained by a chance fulfilment procedure. In order to determine the delivery date depending on how much time each approach needs, you'll need a well-planned supply chain. As a consequence, you will be able to promise your customer a certain delivery date if you have a warehouse that maintains everything in stock and makes sure the procedure is constant. The last but most crucial aspect of running a company is providing excellent customer service. Only when you provide outstanding customer service will you need to deal with repeat business. Long-term client loyalty is a consequence of providing excellent customer service, which ensures customer happiness and trust.

The Principal Functions and Advantages of Warehousing in Supply Chain Management

Any effective supply chain must have a working warehouse. This is due to the important functions that warehouses play in ensuring the efficient movement of products and resources from suppliers to customers along the supply chain. Businesses may get a variety of significant advantages from warehousing, such as higher productivity, cost savings, and better client relations.

Understanding these duties and advantages as well as choosing the appropriate warehouse management system (WMS) software are crucial if you want to get the most out of your warehousing business. The importance of storage in supply chain management and the advantages it offers will be covered in this article. We'll also go over the significance of warehouse software, such as SphereWMS, and how it may raise the effectiveness, efficiency, and profitability of warehousing.

Important Functions of Warehousing in Supply Chains

A crucial element in the supply chain is warehousing. Warehouses are the link between suppliers and consumers and are crucial to the efficient movement of resources and commodities across the supply chain. Warehouses perform a number of distinct functions in supply networks. There are other, somewhat less visible, but no less significant, roles.

A Secure and Safe Storage

Providing safe and secure storage for products and materials is one of the most significant functions warehouses perform in the supply chain. This is necessary to safeguard merchandise from loss, theft, or damage.

Storage space is obviously necessary for inventory needs. Businesses are able to keep sufficient stock levels to fulfil client demand because to this storage space. Without warehouses, companies would have to keep merchandise either at the customer's location or on-site at their manufacturing facility. This is unworkable and would probably result in higher expenses and worse efficiency.

Strategic Place

In the supply chain management process, the closeness of a warehouse to a supply channel is also crucial. By placing warehouses strategically close to important markets or transportation hubs, businesses may save shipping costs and transit times. This ensures that shipments entering and leaving the warehouse do so swiftly and effectively. The choice of a warehouse partner may be made or broken by location since it can significantly affect the bottom line.

Order Processing: Customer orders must also be fulfilled by warehouses. It is the warehouse's responsibility to choose, pack, and ship an order once a consumer placed one. To guarantee that orders are completed precisely and on schedule, this procedure has to be carefully coordinated and planned. Although this procedure might be intricate and time-consuming, a competent WMS will assist to speed things up and reduce mistakes.

Inventory Control" Any supply chain firm must have effective inventory management in order to succeed. Inventory management relies heavily on warehouses to keep track of stock levels and make sure that it is supplied as required. One of the best inventory management systems, SphereWMS gives companies real-time access to stock levels, automates reordering procedures, and generates information on inventory trends to assist them manage their inventory. Making educated judgements regarding inventory levels, manufacturing plans, and client demand is possible with the use of this data.

Delivery Services: Distribution warehouses are crucial to the distribution of products and resources because they guarantee that they be sent in a timely way to the right location. To guarantee that things are delivered securely and on schedule, this procedure has to be carefully coordinated and planned. By giving supply chain organisations real-time insight into stock levels, automating reordering procedures, and producing data on inventory patterns, a competent WMS will assist them in managing their distribution operations. Making educated judgements regarding inventory levels, manufacturing plans, and client demand is possible with the use of this data.

CONCLUSION

One of the most crucial parts of the logistics system and the whole supply chain operation is warehousing. It helps it achieve objectives by enabling an effective product inventory and improving logistics. Additionally, effective storage enhances customer service and has financial advantages. These factors might all result in increased sales and greater company profitability. The foundation of supply chain management organization is warehousing. Here, all essential fulfilment steps are finished. Make a wise choice as a consequence, and carry out each activity cautiously from beginning to end. Any ecommerce business can succeed with the proper supplier and a well-managed supply chain, in our opinion.

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CHAPTER 23

SUPPLY CHAIN MANAGEMENT AND ENVIRONMENT PERFORMANCE IN HEALTHCARE INDUSTRY

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Abstract:

Organizations seeking to reduce costs and improve services must priorities maintaining an effective supply chain. Today, on average, a quarter of hospital costs go toward medical supplies. Due to broad inflation as well as the rising prices of medical equipment and other things, supply chain costs are anticipated to rise. In order to design a way to evaluate environmental quality and its related costs, environmental performance metrics and methods to evaluate quality are examined. This resulted in a two-level supply chain coordinating model that encompasses the majority of green supply chain characteristics.

Keywords: Healthcare, Industry, Management, Medical, Supply Chain.

INTRODUCTION

The movement of goods and services is managed via supply chain management. It includes the transportation and storage of raw materials, inventory for work-in-progress, and completed goods through interconnected or linked networks from the point of origin to the site of consumption. Every industry's backbone is thought to be its supply chain tactics. The supply chain management in the healthcare sector is covered in the paper. The healthcare supply chain management consists of a network that includes suppliers, healthcare facilities, laundry services, food services, and medical equipment. In the long term, the healthcare industry's supply chain management confronts a variety of difficulties. One such problem is cost control, although attention is becoming less focused on it each year. The fast expansion of the company, fuel prices, and the expense of obtaining raw materials, governmental requirements, and new market trends are some problems in controlling supply chain costs, according to a research by logistics decision makers. Supply chain management in the healthcare industry is impacted by uncertainty, although some decision-makers in this sector choose to disregard these worries. The management of the supply chain in the healthcare sector is very complicated. However, the procedures involved in the supply chain are comparable to those in other industries; they begin with the acquisition of raw materials, followed by their formulation, packaging, shipment to wholesalers and retailers, and finally their arrival at the relevant medical facilities and, ultimately, patients. One problem that the pharmaceutical industry faces is supply chain counterfeiting, which results in the introduction of phone medications into the market. As a result, the domain of supply chain management in the healthcare business has to be more visible.

No industry can thrive in the era of competition without thinking carefully about cutting costs wherever they can. The health care sector is seeing a high price increase for almost all of its goods and services. The products of the sector are becoming out of the grasp of the majority due

to the frighteningly rapid rate of cost growth. Since supply chain is a major cost driver in this business, stakeholders are paying close attention to it. It may be challenging to find any magic button that will assist eliminate inefficiencies and save costs since the supply chain in this business is thought to be fundamentally complicated. The supply chain's primary flaw continues to be that each component operates autonomously, leading to mismatched operations that hinder the system from functioning as a whole. In order to comprehend the situation in developing nations better, we also examined the Malaysian healthcare supply chain. The literature review sheds light on topics such as the redesign of hospital inventory management systems, the collection of suppliers and their products through electronic catalogues, and the use of ERP systems to deal with another supply chain bottleneck namely, the ineffective flow of information in the system. They are vendor managed inventory, supply utilization management, virtual centralization of the supply chain, and RFID. At every level of the supply chain, the RFID aids in achieving inventory visibility, accurate counts, and aids in lowering loss and shipping mistakes. Through standardization and appropriate specification, supply utilization management aids in decreasing wastes, value mismatches, and abuse. On the other side, virtual centralization of the supply chain improves levels of collaboration in hospitals, assisting them in cost management and service improvement. With the aid of a CSC example which is jointly owned and administered by several hospitals and healthcare organizations virtual centralization.

Using suppliers, product assemblers, merchandisers, and transportation companies all components of a supply chain supply chain management (SCM) refers to a group of businesses that transmits the product to the end consumer. The movement of products, services, and information beginning with raw materials and ending with the end user is another definition of a supply chain that may be expanded. Supply chain management continues to gain relevance and Due to the difficulty in defining performance measurement criteria in a supply chain, performance assessment in supply networks, particularly multi-vendor supply chains that might be local or worldwide, may be challenging. In addition, supply chain management helps local and international businesses combine excellent management practices and control communication among all participants in a supply chain. Supply chain management is becoming more important in the healthcare industry due to logistics, pharmaceutical items, and patient satisfaction to increase service quality in comparison to other industries. In addition, the healthcare industry has changed dramatically during the last several years. Despite the fact that the methods and techniques present issues in terms of industrial settings, many healthcare companies are aware of the significance of using a better approach and method in order to embrace their supply chain management strategies. The effectiveness of the supply chain management directly affects how well healthcare is provided in both public and commercial.

It is possible that there is knowledge that can serve as a springboard for the advancement of a similar level of comprehension of some aspects of health care delivery systems. This is because successful businesses are able to use the efficient management of supply chains as a source of competitive advantage. The health care system is so huge and intricate that it is now hard for any one person, or for one single company, to comprehend all of its workings, much like the supply chains in manufacture and other sectors. Similar to industrial supply chains, the "supply chain" for health care is made up of numerous independent actors, including insurance companies, healthcare facilities, doctors, employers, and regulatory agencies. These agents all have different economic structures, which means their objectives are also different and frequently at odds with one another. It is very challenging to balance the supply and demand of services since both are

unpredictable in different ways. It is difficult to do this work since the demand for services is influenced by both the technology (i.e., therapies) that are accessible and financial factors, like whether or not a particular therapy is covered by insurance. The alternatives that are open to other parties and their prices are often affected by decisions taken by one party in unclear ways. However, almost all of these complex factors are also present, in one way or another, in manufacturing supply chains. As a result, there is reason for optimism that some insights and modelling methods are developed in the field of automation can be applied to at least some elements of health care delivery systems given the advancements made in understanding these systems over the past few decades.

LITERATURE REVIEW

Mohd Zaini *et al.* [1] The healthcare sector is using green supply chains (GSC) more and more. In order to establish a connection model between GSCM and EP for the Malaysian healthcare industry, this article aims to identify the Green Supply Chain Management (GSCM) and Environment Performance (EP) measurements. It has been suggested to use structural equation modelling (SEM) to create a model of structural relationships. Research hypotheses are being created in accordance with the conceptual model that has been suggested and evaluated.

Seyed Habibollah Mirghafoori *et al.* [2] In industrialised countries, the service sector accounts for around two-thirds of GDP and is the scene of fierce rivalry between service providers and their supply chains. As a consequence, business analysts and academics are becoming more interested in the topic of service supply chain management. The healthcare sector is one of the major service sectors with the most room for growth in terms of sustainability performance. The goal of this research was to uncover the ideas that affect the hospital supply chain's sustainability and to provide a causal model for a sustainable supply chain for hospital services. For this study, two contributions are recognised. In-depth interviews with 18 specialists working in hospitals in Kerman, Iran, were used in this research to pinpoint ideas that affect the sustainability of a medical service supply chain. The original thoughts were reorganised using the Delphi approach into 15 concepts. As a result, the current research suggests a structure for the hospital's sustainable supply chain. This study's first contribution is this. The second contribution examines how extracted ideas relate to one another by employing an intuitive fuzzy cognitive map technique. The findings show that among other ideas, service delivery management is quite important. Originality/value: The sustainability of the hospital supply chain may be increased by concentrating on ideas like service management, capacity management, and resource management.

Aqmar Nur Izzah Norazlan *et al.* [3] studied expands on earlier research on sustainable performance and supply chain management. The purpose of this study is to put out a conceptual framework for analyzing how sustainable supply chain management and sustainable performance in Malaysian healthcare relate to one another. Environment, information and communication technology, cultural change, risk management, and other aspects of sustainable supply chain management were all shown to have a strong and favorable direct association with sustainable performance. An investigational premise is being constructed on the basis of the conceptual proposal. The suggested research approach is used in the little studied Malaysian healthcare sector. Sustainable performance, healthcare sector, sustainable supply chain management.

G V R K Acharyulu and B Raja Shekhar [4] 5.2% of India's GDP is allocated to healthcare. The healthcare sector is expanding at a rate of 15% yearly. Hospitals are now searching for new

sources of competitive advantage and cost-cutting strategies anywhere they can. For effective patient care, it is crucial to investigate supply chain management issues and pinpoint areas where they can raise service standards. Value chains are now seen as the natural next step for businesses to take in order to reduce costs and boost return on investment. To remain viable in the current healthcare climate, the hospital value chain system must be redesigned. The purpose of this study is to evaluate corporate hospitals in India according to accepted standards for a high-quality supply chain system.

Matloub Hussain *et al.* [5] Creating a methodology for identifying, classifying, and prioritizing social sustainability constraints in health care supply chains. The use of an exploratory survey tool enables the identification of supply chain-related obstacles. The discovered impediments are divided into five major categories, and the material has been validated using the views of specialists. Finally, the key categories and subcategories of the obstacles are given a priority using an analytical hierarchical process (AHP). 34 impediments that are pertinent to a health care supply chain were identified during the exploration phase. The following categories were used to classify these obstacles: inadequate infrastructure, organisational culture, poor coordination, disparate stakeholder interests, and uncertainty. The AHP gave organisational culture and inadequate coordination the highest priority. Overall, it was determined that the most significant obstacles to a health care supply chain were a lack of managerial support, a lack of commitment, and a lack of coordination. Research limitations/implications: The constraints to social sustainability were the only ones examined and given priority in this research. Future studies should examine how the cited constraints affect the general efficiency of the hospital supply chain. Practical implications: By removing obstacles to social sustainability, the study's results may help the local healthcare sector achieve its goals. This will make it easier to execute social sustainability initiatives that will improve the performance of the supply chain as a whole. Social implications: Supply chain managers are being pressured to evaluate their social consequences on the communities as social sustainability has gained relevance. This is crucial in service supply chains, like those in the health care industry, because human interaction occurs at every level. The classification and prioritising of social sustainability strategies across health-care supply chains and general service care supply chains have not been addressed, despite practitioners' and researchers' rising attention on the social component of sustainability. By making a contribution to both the academic literature and the real-world health-care setting, our research seeks to fill this vacuum.

J. Paul Dittmann [6] According to APQC's study, businesses utilising spend analysis solutions have less expensive and more effective procurement procedures. Many businesses are spending more time on spend management, which is the act of analysing spending habits to find chances for long-term savings, as a result of the current emphasis on cost reduction. Spend analysis, the process of determining the who, what, when, where, why, and how of an organization's spending, is one part of spend management that may have a significant impact on the supply chain. A company may combine both its suppliers and its expenditure by using a spend analysis application to get useful insight into its procurement costs. The enhancements to supply chain operations that expenditure analysis may bring about have been benefited by several firms. The Open Standards of APQC Nearly 70% of responding firms have started expenditure analysis programs, according to procurement benchmarking. The aim of APQC was to compare businesses that use expenditure analysis to other organizations in several critical categories. According to APQC's study, companies using spend analysis systems have stronger supplier

relationships and more effective procurement processes. Spend analysis offers firms advantages in terms of cost effectiveness, cycle time, process efficiency, and employee productivity. Reduced Total Cost for businesses that have started spending analysis programs, the total cost of acquiring goods and services. A firm with a spend analysis program and $5 billion in sales would, on average, spend $8,500,000 on procurement operations, but a business of the same size without one may spend $19,500,000 on the same tasks. For businesses that don't do expenditure analyses, this adds $11 million in extra procurement costs.

DISCUSSION

One of the most important sectors of the economy and a vital one in daily life is healthcare. It is also important for determining how developed a nation is. The healthcare sector may both help individuals recover from ailments and generate income for a nation by luring medical tourists. Even though the healthcare industry is one of the worst polluters of the environment, recycling these materials needs major funding and special procedures. However, it is crucial to provide supplies for hospitals and medical facilities. Multiple fatalities result from a delay in providing vital supplies and infrastructure to these places. Consequently, putting supply chain management (SCM) into practice while maintaining a safe environment and a fair profit is a difficult undertaking. SCM, which includes procurement, processing, inventory management, shipping, etc., is the process of turning raw resources into finished products or services provided to end consumers. By creating the optimal strategy for these tasks, manufacturing costs may be reduced and customer satisfaction can rise. The SCM process consists of several components, each of which is essential to producing the optimum outcome. After the SCM concept, other more pertinent ideas such as green SCM, fourth-party logistics (4PL), 3rd logistics (3PL), etc. have arisen. Sustainable supply chain management (SSCM), which is closely tied to green SCM, is one such idea. Unlike green SCM, which exclusively focuses on environmental concerns, SSCM also includes a wide range of other challenges, including economic ones. As a result, SSCM is a more sophisticated and intricate strategy than green SCM.

There are several obstacles in the way of SSCM's practical use. Companies have difficulties, nevertheless, in designing development programs to remove these obstacles due to a lack of resources, including human resources (HR), money, knowledge, time, and other factors. Therefore, it is crucial to first identify any obstacles. The second step is to tailor each obstacle to the study setting before ranking them in order of priority. The ranking of variables has been done in a variety of ways. Multi-criteria decision analysis is one of the most well-liked and beneficial techniques. The best-worst method (BWM) and the combined compromise solution technique will be used in this research to rank the hospitals and the hurdles in order to determine which hospitals should focus more on adopting SSCM.

Condition of SCM nowadays in the healthcare sector

The supply chain for pharmaceutical goods in the healthcare sector is essential for guaranteeing both a high level of patient care and sufficient medicine supplies for pharmacies. Cost-wise, it's estimated that supplies make about 25–30% of hospitals' operating expenses (Roark 2005). In order to guarantee that service and cost goals are reached, it is crucial that this be handled well. The following are some of the challenges that are present at the distribution portion, namely from the wholesaler to the hospital:

Life cycle of a product: It may take eight years to develop the product into something that can be commercialized when the active component is patentable. Alternative items might hit the market once the patent runs out, or businesses could lower the price. The distribution channels are under increased strain as a result of new technology's shorter life cycles.

Profit margins: Operating margins are low, especially in the wholesaling industry, despite pharmaceutical items having high unit costs. Hospitals, merchants, and manufacturers' power over price is one factor contributing to this.

Forecasting: It is challenging to determine the precise demand for medications. One of the problems is the lack of precise consumption statistics. However, there are further difficulties due to the absence of a standardized nomenclature for healthcare items and clinical preferences. Lack of knowledge about supply chains: Low levels of knowledge exist about supply chain management, especially in hospitals. As a result, managers lack the necessary tools to regulate the medicine supply.

In light of this situation, many projects have been launched in recent years with the goal of lowering supply chain costs and enhancing customer service. Just-in-time (JIT) techniques have formed the foundation of the first advancements. As a result, stockless inventory systems have been introduced, furthering this development. Using JIT and a stockless strategy, a business may save expenses associated with inventory storage while maintaining service levels. Recently, it has been proposed that the stockless method should only be utilized for large volume items and that low volume medical supplies should be handled in a more conventional manner. To support this, however, there is a need for better information and communication technology (ICT) systems, automated order processing, and suppliers primarily wholesalers close to the hospital to facilitate quick replenishment. JIT and stockless strategies both fall under the category of "pull" type inventory management solutions

Numerous economic, environmental, and social issues often affect hospital supply chains. Greater service delivery efficiency is required from an economic perspective due to rising healthcare costs. Hospital expenses make up over 40% of all medical spending, according to the Organization for Economic Co-operation and Development. Supply chain expenses account for 30% to 40% of a hospital's budget, although they may be decreased by up to 8% by following best practices. Additionally, these best practices enable clinical staff to concentrate on their primary duty of providing care.In terms of the environment, hospital operations and services have high material, energy, and water requirements, produce a lot of waste (particularly hazardous waste when compared to other industries), and have a high carbon footprint. For instance, the Sustainable Development Unit of the National Health Service in England calculated that 39% of public sector emissions in that country are attributable to the healthcare sector, with 57% of those emissions coming from procurement, 18% from energy, 13% from travel, and 11% from other sources. Furthermore, acute services account for the majority of the total, or around 50%, of the cost. Hospital supply chain issues also directly affect society. Internally, despite being significant employers, hospitals frequently use non-standard forms of employment, pay levels have declined in comparison to other economic sectors, women are paid less and are less frequently recognized than men, daily working hours exceed legal limits, and safety considerations are frequently disregarded. Long working hours and shift work not only raise the risk of occupational accidents, burnout, and psychological stress beyond that of other occupations, but they also have an effect on patient care.

From an external perspective, hospitals have a significant effect on the populace since health services affect peoples' quality of life in one way or another. Nevertheless, stated worldwide issues include insufficient access to and delivery of health services to meet the demands of the population. SSCM techniques and sustainable performance are therefore related to the objectives of achieving the triple challenge of being more effective, more environmentally friendly, and providing better circumstances to both employees and communities serviced. Best practices are associated with the aim of that which is seen as superior by the majority, regardless of how practices are defined, whether as organizational routines, regulations, or standard processes. In other words, it is possible to attribute bad performance to a lack of best practices.

SCM is described as the "planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities" by the Council of Supply Chain Management Professionals, who also highlight its significance in the integration of the various parties involved in the entire supply chain. In particular in the contemporary environment of fierce rivalry, globalization, and active consumer engagement, SCM interest is in its contribution to a competitive advantage, in terms of differentiation and the reduction of operational costs. It is suggested that adopting exceptional methods leads to improved SCM and greater performance. Numerous papers, particularly from an economic standpoint, suggest the presence of important connections between SCM techniques and organizational performance. Beyond the previously stated economic emphasis, a new development in SCM research refers to the need of taking sustainability which takes into account the environmental and social dimensions into account. This is because of two factors. First, indicators of global poverty, health, working conditions, and climate change have sparked an interest in sustainable development promotion on a global scale. Sustainable development is defined as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Second, given that businesses are often to blame for social and environmental issues like pollution and poor working conditions, they also have a responsibility to assist lessen these consequences and support economic growth.

An essential part of a company's operations is the management of the supply chain. Regardless of the type or objectives of the firm, supply chain management is essential to attaining efficiency, effectiveness, and sustainability. This idea may help to explain why the Nigerian Ministry of Health conducted a workshop from April 16 to 18, 2008, to address the many problems that prevent the country's healthcare supply chain from achieving its sustainable development objectives. The goal of the workshop was to redesign an efficient, socially responsible, and environmentally friendly supply chain management (SCM) system.

The government's goal in holding the workshop was likely to discuss how to set up a healthcare supply chain system that would guarantee ideal service delivery by making health commodities and medical products economically accessible to last mile users not only quickly but with little strain on the environment and community.The workshop was therefore set up as a result of the government's apparent awareness that integrating sustainability into supply chain management had evolved into a tactic for achieving competitive gains in the majority of private organizations; such an initiative could be successfully applied to the public sector healthcare supply chain. While many factors affect a country's ability to efficiently procure and deliver the right quality/quantity of health commodities (medicines, equipment, consumables, and information) while putting the fewest demands on the populace and without drastically depleting the planet earth, is a major managerial constraint.

In addition to sustainability issues, the developing storage and supply networks in the Nigerian healthcare sector further hampered access to drugs and basic healthcare. According to a baseline study conducted by the Federal Ministry of Health in 2010, the medical supply and distribution chain in Nigeria could best be described as being poorly coordinated, leading to increased resource wastages and the inability to secure access to necessary medications and health consumables. Therefore, it is crucial to have a hospital supply chain system in place that is not only effective but also socially and ecologically sustainable.

A supply chain is an important network of virtual organizations connected via upstream and downstream processes that increases value by guaranteeing that goods and services are accessible to the final consumers. Supply chain can be viewed as a system of interconnected processes required for the forward and backward flow of pharmaceuticals, medical devices, vaccines, and consumables to satisfy those who provide clinical services, as well as the system of supply information required to track and assess activity. The provision of products and services to a variety of consumers while optimizing the triple bottom line (profit, people, and planet) as a gauge of efficiency is the primary goal of a sustainable supply chain. The notion of combining environmental and social issues in managing the movement of products, information, and funds from their place of origin to where they are most required at the proper time, cost, quantity, and quality is known as the sustainable supply chain (SSC).

The hospital supply chain is being improved, and hospitals and healthcare service providers are starting to recognize the various advantages of scanning technology. Instances of firms that have used barcode scanning as a form of inventory monitoring have shown decreased inventory losses and obsolescence, as well as a promotion of a change from push to pull in supply chain strategy. Due to its higher cost, RFID usage has grown slowly but steadily for logistics and supply chain applications, but has been gaining popularity for patient care and monitoring equipment inventory in operating rooms.

In spite of this, more than 100 hospitals in the US use RFID in various aspects of supply chain management. RFID is being utilized there and abroad to distribute pharmaceutical supplies as well as other goods like linen. As hospitals realize the enormous savings potential afforded by RFID and the price of scanning equipment continues to drop, concerns regarding the installation cost are dissipating. The healthcare industry has had to adjust to a number of issues since the COVID-19 epidemic, with cold chain assuming increasing prominence. The global healthcare sector is one of the biggest and fastest expanding in the world. It consists of a number of industries, including those in healthcare services, pharmaceuticals, medical devices and supplies, biotechnology, and alternative medicine. Since healthcare providers are always under tremendous price pressure, providing high-quality healthcare services while lowering costs is gradually becoming a major strategic objective. While healthcare providers have rightfully focused their efforts on locating and removing waste in clinical operations, implementing healthcare supply chain principles is a crucial and effective way to further reduce healthcare expenses[7]–[9].

Supply Chain Administration (SCM), according to the Council of Supply Chain Management Professionals is the management of all sourcing and procurement, conversion, and logistics management operations. It is important to note that it also entails coordination and cooperation with channel partners, which might include suppliers, middlemen, outside service providers, and clients. SCM seeks to strategically match product and service offerings to different client

groups. In fact, according to Anderson, Britt, and Favre6, the seven guiding principles of SCM are to segment customers based on their service needs, adapt the logistics network to serve various customer segments, align demand planning across the supply chain, differentiate products and services closer to customers, outsource strategically, create information technology that supports multi-level decision-making, and adopt both service and financial metrics. Although SCM principles have been successfully adopted in many industries, the healthcare sector has not witnessed significant advances as a result of these approaches.

Healthcare benefits from the transfer of knowledge from other sectors, despite the unique characteristics of the healthcare supply chain (HSC) that make transference especially difficult. The HSC is often portrayed as fragmented and inefficient despite the fact that it is dynamic, complicated, and marked by uncertainty.

This could be because the traditional healthcare supply chain cannot work as a system since each phase functions independently. Supply chain performance will be enhanced through effective communication and integration of all stakeholders. 12 The healthcare business has struggled to adopt and implement system-wide SCM methods due to the mismatched incentives and competing objectives of the different stages and divisions. The primary objective of the current healthcare supply chain is to satisfy the expectations of stakeholders by providing timely delivery of items of the highest quality in the appropriate amounts and cutting-edge services. Eight main categories can be used to categories the participants in the health care supply chain: manufacturers/suppliers of pharmaceuticals, medical devices, and surgical supplies; wholesalers, distributors, and group purchasing organizations; hospitals, integrated delivery networks, doctors, pharmacies, and nursing homes; clients/patients; relatives/careers; governmental organizations; regulatory bodies; and insurance companies. Hospital supply chains, which are pertinent to this research, are intricate systems that depend on the movement of goods and services to meet the requirements of both patients and those who care for them[10]. To offer healthcare services effectively and efficiently, patient logistics, clinical routes, data exchange, and integrated supply chains have all become essential. The main variables that affect hospital supply chain performance are trust, knowledge sharing, IT integration, and supplier integration. So, reorganizing hospital services, which are characterized by linked supply chains, is an example of a decisive method to reduce resource use and improve the quality of healthcare.

CONCLUSION

Every healthcare organization must have an effective supply chain. In the area of healthcare supply chain, numerous advancements and innovations have been made, particularly in information sharing, inventory control, the procurement process, communication, etc. All of these advancements were made possible with the aid of information technology as well as the cooperation of stakeholders. The participants in the healthcare supply chain must improve their segmentation, agility, alignment, measurement, and teamwork skills. Today's healthcare service providers are under a lot of pressure from greater competition, government restrictions, rising costs, and consumer demand for high-quality goods and services. The healthcare industry has to set up partnerships from the start in order to improve their chances of overcoming supply chain obstacles.

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CHAPTER 24

IMPACT OF SUPPLY CHAIN MANAGEMENT IN ORGANIZATIONAL PERFORMANCE

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Abstract:

Organizations now have more opportunities to increase quality processes, draw in stakeholders, and keep costs to a minimum thanks to supply chain management. Cost reduction throughout the supplier value chain will be accomplished with thorough logistical planning.

Keywords: Organizational, Planning,Supplier,Supply Chain Management

INTRODUCTION

Competing businesses are growing both locally and internationally in this age of globalization. The current situation demands that businesses provide customers with high-quality services and goods while reducing waste. These businesses should also be able to properly and efficiently manage their supply chains. While these businesses attempt to compete in a challenging global marketplace, they encounter a variety of problems. The market is becoming more consumer-focused, dynamic, and international. Customers want a bigger selection of products, higher quality, quicker delivery, and more dependability. The number of product kinds is growing but their lifespan is shortening. The speed of technological advancement is really rapid.

Organizations must comprehend the significance of supply chain procedures in order to be and stay competitive. These practices will assist the firm function better. Additionally, cooperation with the supply chain is essential for enhancing performance. The networks must have solid upstream and downstream integration. For this reason, supply chain management is essential across all industries. Due to its operational success over the last two decades, supply chain management has attracted the interest of many academics and practitioners. Despite its success, a lot of firms are struggling to comprehend the problems with the supply chain. On the other hand, green marketing is a notion that may be used with consumer, industrial, and professional products. It incorporates a broad variety of operations, including as changing advertisements, packaging, the manufacturing process, and the product itself. Resource depletion, ozone depletion, hazardous waste disposal, deforestation, and global warming are challenges that have recently come to light. There are opportunities for green marketing, which encompasses things like green promotions, green logistics, green pricing, green positioning, green design, and green target marketing.

This is so that organizations may utilize it to improve their position relative to rivals. Businesses are attempting to integrate green marketing tactics into their existing marketing plans, including industrial marketing, strategic partnerships, consumer segmentation, promotion, retailing, distribution, pricing, package design, product, and planning. The reasons why businesses are

adopting these adjustments and advocating a green strategy are not always evident. Businesses may be becoming green for other reasons than increased performance in environmental matters and competitiveness. In fact, one of the most cutting-edge and significant strategies that can be employed to improve the connection between the company and the community is green marketing. However, it may also be used to defend the environment from organizations.

Supply chain management may be a useful tool for a company to increase its competitive edge. Additionally, supply chain management may be a useful instrument for preserving the success, expansion, and stability of the company. Supply chain management refers to a set of practices used by businesses to advance the efficient administration of their supply chains. The best supply chain efforts are those that have an impact on the core processes, the whole chain, and its individual components. The supply chain's activities are influenced by contextual circumstances. These variables include location, business size, industry, and the length, kind, and length of the supply chain. Building an efficient supply chain is crucial for establishing and maintaining the firm's services and goods' competitive edge. According to research, the supply chain's effectiveness is influenced by vital information that has been integrated. Information sharing, customer interactions, and supplier collaboration are three essential supply chain management techniques. It has been determined that the principles of supply chain management include long-term relationships, supply chain leadership, process integration, collaboration, award sharing, risk, objectives, and vision. Because the economic climate is becoming increasingly difficult, it is crucial for company operations to stay competitive. Consequently, it is crucial to adopt the supply chain to enhance corporate operations. Later on, this will convert into better organizational performance. Despite the fact that supply chain management is not a new technique, a number of problems still need to be solved. These problems include a lack of comprehension of supply chain management procedures and a lack of fundamental knowledge of supply chain management despite awareness of its significance.

The fundamental premise behind the concept of organizational performance is that the organization is a collection of productive, human, and capital resources that are employed to accomplish a common objective. If these assets provide value to the organization, they will be committed to the organization. As a consequence, value creation serves as the foundation for performance. As long as the value supplied is more than the asset's projected value, the committed asset will continue to be accessible to the organization. There are several organizational constituencies that may be used to assess the functioning of the company. As a result, there are several ways to interpret whether a firm is doing well. For various stakeholders to make choices, several performance metrics are needed. There are three aspects that pertain to a firm's performance. The first three components of financial performance are profit, return on investment, and return on asset. Market share and sales make up product market performance, while shareholder return, which comprises of economic value added and total shareholder return, comes last. In order to carry out the study, it is necessary to have a united view on organizational performance. Regardless of whether adopting green practices is motivated by internal initiative or external pressure, the choice to do so rests with management at both the top and lowest levels of the firm. The goal of green supply chain management is to enhance business-like economic performance, ecological performance, organizational performance, environmental performance, financial performance, economic performance, and environmental performance.

LITERATURE REVIEW

Hamid Babaei Meybodi *et al.* [1] At order to better understand how supply chain management (SCM) affects organizational performance and customer satisfaction in two companies located in Shiraz Industrial Estate, the current research was done. The variables of supply chain management, organizational performance, and customer satisfaction have thus been specified in light of the study topic. This research has an applied aim, and it is a descriptive-correlational study in terms of nature and methodology. There are 80 persons in the sample and 100 in the statistical population. Prior to employing SPSS and LISREL to analyze the data, the research's reliability and validity were assessed. The data gathered show how supply chain management affects both organizational effectiveness and consumer satisfaction.

Salah M. Diab *et al.* [2] researched which focuses on the Jordanian nutrition industries, aims to determine The Impact of Green Supply Chain Management Practices on Organizational Performance. The information was gathered by a questionnaire; the consistency rate was 85%; and the overall tool's Cranach's alpha is (0.89). The link between the dependent and independent variables was examined using means, standard deviation, and simple and multiple linear regression analysis. The characteristics of green supply chain management methods served as the foundation upon which the researcher created the model and hypothesis. The researchers picked six companies that were experts in the industrial food industry and used the green manufacturing idea. The study's findings indicated that green supply chain management methods and its components have an effect on organizational performance. Both academic and administrative repercussions are a result of this investigation. The researchers take into account all aspects of green supply chain management that affect organizational success, including operational, financial, and environmental performance. As a recommendation for this research, it may be crucial for managers and businesses to comprehend green supply chain management in order to boost advantages and sales.Riaz Kazim *et al.* [3] researched assessed the impact of green supply chain management implementation on overall company performance. This study focused on businesses operating in the e-commerce sector that are headquartered in Karachi, Pakistan. According to the study, there is a clear link between the effectiveness of an organization's supply chain, which encompasses factors like supplier cooperation, green purchasing, green logistics, and customer cooperation. The findings shown that if green supply chain management improves operational efficiency, company performance increases. According to the report, implementing a sustainable supply chain inside a business has a favorable effect on its economic performance and competitiveness, giving it a competitive advantage. This research also paints a clear picture of the significance of the green chain for employee wellbeing and how it affects corporate performance.Suhong Li *et al.* [4] Since rivalry is now across supply chains rather than between businesses, effective supply chain management (SCM) has emerged as a potentially significant method of protecting competitive advantage and enhancing organizational performance. This study tests the connections between SCM practices, competitive advantage, and organizational performance while conceptualizing and developing five dimensions of SCM practice (strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing, and postponement). Structural equation modelling was used to investigate the correlations suggested in the framework after data from 196 organizations were gathered for the research. The findings show that increased SCM practice may boost competitive advantage and boost organizational performance. Additionally, competitive advantage may directly and favorably affect how well a company performs.

Ingy Essam Eldin Salama [5] The development and analysis of a conceptual framework linking organizational performance to resource-based organizational capacities and inter-organizational practices is the main goal of this study. It specifically looks at the connections between organizational learning, supply chain management techniques, and knowledge management competence. Such a research is significant because it adds to the body of knowledge that shows how organizational practices and skills affect organizational performance. By using the suggested conceptual framework in the context of Egypt, which is presently understudied, it also adds to empirical information. The research methodology used in this study uses self-administered questionnaires to conduct an empirical evaluation of the proposed correlations between research variables on 63 factories with more than 100 workers that are situated in the industrial city of New Borg Al-Arab. The results of this study show that supply chain management procedures and organizational learning both benefit from knowledge management capacity. Organizational performance, however, is unaffected by any of the study factors, including knowledge management capacity, organizational learning, and supply chain management methods. The primary takeaway from this research is that managers may find knowledge management skills helpful in anticipating organizational learning and coordinating supply chain management procedures among supply chain participants. Additionally, it may be determined that factors other than knowledge management competence, organizational learning, and supply chain management methods influence organizational performance in the factories under consideration.

Jutamat Sutduean *et al.* [6] This empirical study's primary goal is to examine the relationship between supply chain management and organizational performance. Additionally, the present research is interested in exploring how green marketing mediates the link between supply chain management and organizational performance. This article discusses managing green marketing using supply chain management techniques. The analysis of supply chain management literature via the perspectives of organizational performance and green marketing will be the paper's main contribution. The research found that supply chain management strategies have an influence on an organization's ability to compete and its overall success. Through product innovation, quick time to market, dependable delivery, high product quality, and affordable pricing, it is anticipated that they will increase their competitive edge. The competitive advantage of the firm is impacted by a variety of supply chain management methods, according to earlier research. Every element of the supply chain must be changed in order to attain high performance, including the design of the processes. This is supported by the study's results.

Thi Thanh Tam Nguyen *et al.* [7] evaluated how corporate entrepreneurship affects workplace culture, supply chain management effectiveness, and company success. It specifically looks at how organizational culture and corporation scale influence the link between corporate entrepreneurship and financial success. Utilizing the PLS-SEM approach, the study is conducted on 96 chemical businesses in Vietnam. The findings show that corporate entrepreneurship favorably impacted business performance via organizational culture and supply chain management performance, with organizational culture and firm size acting as moderators.

Hasani Behzad and Seyyedvalilou Mirmahmood [8] discussed today, with the expansion and improvement of marketing strategies, it is impossible to overlook their influence on the commercial environment. Organizations may succeed in creating more value for clients and other interested parties by using marketing and supply chain management. As a result, 390 samples were chosen using the Cochran method based on the number of the statistical

population, which is equal to 1000, after determining the objectives, variables, and factors of designing the appropriate measurement tool(s), preliminary field studies, and validation of the data measurement tool(s), preparation of the final questionnaire, and distribution among the relevant experts. In order to statistically analyze the answers to the study questions, structural equations were utilized, and PLS statistical software was used. Data analysis revealed a substantial positive link between the variables, which was supported by the model's excellent fit and eventual approval.

DISCUSSION

The goal of supply chain management is to assess the methods for organizing, implementing, and overseeing the production of raw materials, finished goods, and finished goods delivery to the final consumer. The interconnected supply chain activities start with a customer order and are finished once the goods are delivered to the customer. Academics, consultants, and business managers are all paying more attention to the idea of supply chain management (SCM). The definition of SCM makes clear the strategic nature of coordination between trading partners and explains the twin goals of SCM: to enhance the performance of both the particular business and the whole chains. SCM practices are a group of actions made by a company to support efficient supply chain management. The downstream and upstream ends of the supply chain are included in the multi-dimensional idea of SCM practices. Data gathered from survey respondents is used to generate and empirically evaluate operational measures for the constructs. The connections that have been proposed are tested using structural equation modelling. The present study is anticipated to improve understanding of the breadth and activities connected with SCM and enable testing of the antecedences and repercussions of SCM practice by concurrently examining SCM practices from both upstream and downstream sides of a supply chain. Additionally, it is anticipated that this research will provide useful guidance for measuring and implementing SCM practices in an organization and facilitate further research in this area by offering a validated instrument to measure SCM practices and by providing empirical evidence of the impact of SCM practices on an organization's competitive advantage and performance. Supply chain management practices (SCMP) are defined as the methods used in integrating, managing, and coordinating supply, demand, and relationships in order to satisfactorily serve customers. These practices also include tangible technologies that play an important part in the collaboration of the focal firm with its suppliers and customers.

Early efforts at empirical SCM research focused mostly on creating tools for assessing SCM processes. Some scholars have lately concentrated their research efforts on examining the connection between SCM practices and organizational performance. They have operationalized organizational performance using financial and market criteria (return on investment, market share, and profit margin on sales, the growth of return on investment, the growth of sales and the growth of market share). Additionally, they looked at how SCM practices, operational performance, and SCM-related organizational performance were connected. Due to the subjective and objective operationalization of the organization's performance, these studies and others have yielded a variety of conclusions. There are three types of supply-chain-driven organizational performance. The first thing resource performance shows is value creation in the form of efficiency. Second, output performance indicates value addition as the company's capacity to provide top-notch client care. Finally, the firm's capacity to adapt is reflected in flexibility performance as value addition. The difficulties involved in delivering goods and services to the right location at the right time at the lowest possible cost increased as competition

in the 1990s became fiercer and marketplaces went worldwide. Businesses started to understand that making their whole supply chain competitive is more important than just increasing internal efficiency. Supply chain management (SCM) knowledge and application are now prerequisites for maintaining competitiveness in the global competition and growing financially. These are the reasons the researcher felt the necessity to conduct this study, particularly in the context of small enterprises where supply chain management ideas have received little attention and have been disregarded. The results of this study will thus aid small firms in their efforts to incorporate SCM methods into daily operations in order to enhance their company performance and stay in contact with their suppliers.

Strategic Vendor Collaboration: It is described as the SC potential in which it fosters customer and partner cooperation to foster loyalty, trust, and integration for long-term sustainable success. Additionally, the word is based. In order to boost operations and SC performance, SSP develops a contract between the supplier and the customer to be on the same page about the production and demand of the items. Performance of the Organization: This word refers to the feature of how the firm is able to accomplish both internal objectives (i.e., operational success) and goals in the market. Achieving (OP) organizational performance is understood to depend on increasing productivity while maintaining low costs and improving profit margins. The function of OP is also receiving a lot of attention these days as businesses want to develop creative skills to boost performance. The new paradigm for becoming a successful firm is to adopt those skills that can create a diversity of goods with the least amount of effort.

Organizational Performance and Customer Relations: The connection between a business's absorptive capacity and its technical aptitude as well as its correlation with its capacity for building client relationships, which improves the performance of the firm as a whole. Data for this research was gathered using the survey approach. Across all, 316 questionnaires were circulated in South Korea's semiconductor sector, with 158 sample businesses taking part. Through MPlus Exploratory Structural Equation Modeling, the collected data was examined. The analysis's findings demonstrated that, when combined with a company's ability to incorporate cutting-edge technology in its new product development program, absorptive capacity can help a company perform better by helping it develop new products, improve market performance, and increase profitability. The phrase "firms' technical capacity" refers to this. When strong associations with clients are formed in order to get knowledge connected to the customer connection capability, the performance of the business is furthermore boosted via the firm's absorptive capacity. This research is valuable in that it sheds light on the significance and effects of the ability of high-tech small and medium-sized businesses to absorb external knowledge and use it for practical purposes.

Today, businesses all around the globe are expressing tremendous anxiety about the many ways their goods reach their ultimate consumers, clients, or customers. Supply chain management has established itself as a significant problem in commercial organizations and management in the modern era to the point that it is seen to be the cornerstone for attaining customer happiness as well as productivity.

It has been underlined that supply chain management aims to improve both individual and organizational performance while also strengthening the nature of relationships between trade partners. Supply chain management is a capacity monitoring tool that aids businesses in effectively managing the movement of both necessary and non-essential goods, services, and

information from suppliers to distribution centers and manufacturing plants to the end consumer. No matter where they are in the supply chain, all firms must be sure they address supply and demand challenges. Every organization's efficiency and production level will increase when the supply of raw materials is reliable and available when required. As a result, all industrial firms place a larger emphasis on productivity capacity.

Organizational effectiveness: How successfully a company achieves both its financial and market-oriented goals is a key indicator of its organizational performance. The key short-term objectives of SCM include efficiency enhancement, inventory reduction, and cycle time reduction, while long-term objectives include increasing market share and revenue for all supply chain participants. Financial metrics have been used as a tool to compare entities and evaluate an entity's behavior across time. Any organizational endeavor, including supply chain management, may ultimately result in increased organizational effectiveness. Organizational performance has previously been measured using a variety of market- and financial-based metrics, such as return on investment (ROI), market share, profit margin on sales, ROI growth, sales growth, market share growth, and overall competitive position.

A company may increase their competitive performance by integrating their internal activities with external actors like suppliers and consumers via the use of supply chain management (SCM). When various supply chain methods are used effectively and linked together to integrate the supply chain, a competitive advantage in supply chain integration might result. To achieve outstanding and effective supply chain performance, a business must integrate its internal cross-functional barriers as well as its exterior integration of suppliers and consumers. There is no question about the significance of supply chain management, and several studies have supported the significance of organizational supply chains, which have an impact on the flexibility and agility of production. Studying the supply chain management techniques that the manufacturing sector has mostly embraced is thus interesting.

Supply chain management companies have long exchanged data and information, worked together to produce goods, negotiated terms and pricing, asked prospective partners about their product requirements, and spoke with their customers and suppliers about demand projections. The success of the organization depends on these collaborative actions. Knowledge management (KM) adoption provides collaborative processes that make the supply chain more adaptable and receptive to information changes coming from various working units within the company. Knowledge management is the conversion of unstructured data from many sources into coherent knowledge that can be distributed to those who need it. For workers and supply chain partners to have access to this data, employees' skills, knowledge, and experiences must be recorded and made easily accessible. Knowledge management thus acts as a predictor for enhancing organizational performance.

To guarantee the effectiveness of the integrated supply chain network against this background, a company using supply chain management strategies must communicate knowledge, such as the causes of production delays and customers' information and expectations, both internally and externally. Lack of information exchange among supply chain participants will have a substantial impact on the organization's overall profitability. Examining the influence of these factors is necessary given the significance of SCM practices to organizational performance and the significance of knowledge management in improving organizational performance. The aforementioned phenomena emphasizes how crucial SCM procedures are to the effectiveness of

organizations. Furthermore, it is crucial to comprehend how knowledge management procedures affect the interdependence of supply chain management techniques and organizational performance. Consequently, research is done to ascertain how SCM techniques affect knowledge management procedures and organizational performance.

A supply chain is a network of production and distribution centers that work together to plan, manufacture, ship, and support the commerce of a network of businesses' goods. It is a new technology that benefits both customers and businesses. A strong supply chain management system and websites are essential for an e-commerce business (SCM). Despite geographical challenges, SCM concentrates on acquiring raw materials, producing the product, and delivering the product before it reaches the client. The transfer of raw materials to the factory and consumers is referred to as the "supply chain". Supply chain management has played a significant role in the manufacturing industry for a long time and is an essential component of the total production process. Typically, each business maintains a supply chain section that is completely integrated, ensuring seamless product production and prompt delivery. With the rise of e-commerce, this aspect has acquired a whole new meaning since the supply chain's operation may either create or destroy an enterprise. The business operations of manufacturing, sourcing, transportation, and actual delivery of commodities to end customers are all included in supply chain management. All of these procedures are coordinated and integrated into a seamless process by effective supply chain management. SCM collaborates with partners in addition to the company's divisions, such as distributors, airlines, outside companies, and information system suppliers. E-commerce, often known as electronic commerce, is the term used to describe any commercial transaction including the transmission of information via the Internet. By definition, it includes various commercial activities that utilize the Internet as a means for information exchange, financial transactions, or sometimes both. E-commerce is the buying and selling of things via the Internet, therefore in order to ensure an effective supply chain, the movement of items often has to take place correctly and on time, in addition to payment between the two sides. The most important component that must be swift, uninterrupted, and secure for businesses to succeed in e-commerce is the supply chain.

Organizational Performance and Supply Chain Management Techniques: The competitive advantage and organizational performance of the company are impacted by supply chain management procedures. They are anticipated to increase their competitive edge via product innovation, speed to market, delivery reliability, product quality, and pricing. According to earlier research, the competitive advantage of the firm is impacted by a variety of supply chain management methods. Examples include how the strategic supplier alliance may improve supplier performance, raise customer satisfaction, and shorten time to market. Sharing information results in the supply chain's integration, which enables a company to produce the product and deliver it fast. Information sharing and information quality both improve the quality of a relationship and customer satisfaction. A delay plan enhances the supply chain's flexibility while balancing the global efficiency and the customer response. High supply chain management standards across organizations will affect their ability to maintain a competitive edge. When compared to its rivals, a business with a competitive edge may deliver goods faster, be more reliable, produce goods of greater quality, or charge less. As a consequence of these skills, organizational performance will be improved. The organization's competitive edge may also influence relationship effectiveness, loyalty, customer satisfaction, and economic success.

When implementing the greening of the supply chain, organizations also take a number of additional steps, such as obtaining sustainability certification. Corporate green supply chain marketing strategies have the power to boost productivity and profitability, boost sales, and affect market share. Additionally, it minimizes rework, makes the most use of available resources, and employs reverse logistics to create new market possibilities. In the industrial industry, researchers have shown a strong correlation between economic success and environmental management. The company's financial success has a substantial influence on green supply chain management. Green supply chain management has a direct influence on the organization's success. Green marketing initiatives might also boost performance.

CONCLUSION

It covered customer relationships, degree and quality of information exchange, strategic supplier partnerships, and delay, all of which were helpful in assessing organizational effectiveness. However, there is a positive and strong correlation between organizational success and strategic supplier partnerships.

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