PRINCIPLE OF SUPPLY CHAIN MANAGEMENT

Venkatesh Ashokababu
Dr. Nalin Chirakkara

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CHAPTER 1

A BRIEF INTRODUCTION TO SUPPLY CHAIN MANAGEMENT SYSTEM

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ABSTRACT:
In todays globalized and linked corporate world, supply chain management is essential. It includes everything that goes into the movement of commodities, services, and information from suppliers of raw materials to final consumers, including the planning, coordinating, and carrying out of those operations. Organizations need effective supply chain management in order to gain a competitive edge, improve customer happiness, and maximize operational effectiveness. An overview of the main ideas, problems, and tactics involved in supply chain management is given in this chapter. It examines the many supply chain elements, including as purchasing, manufacturing, logistics, and distribution, emphasizing their interdependencies and the value of flawless collaboration.

KEYWORDS:

Chain Management, Competitive Edge, Gain Competitive, Phrase Supply, Supply Chain.

INTRODUCTION

Supply chain management in business refers to a process that includes procurement purchasing raw materials/components, operations management ensuring the production of high-quality products at a high rate with good flexibility and low production cost, logistics, and marketing channels so that the raw materials can be transformed into a finished product and delivered to the end customer. The design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging global logistics, synchronizing supply with demand, and measuring performance globally is a more specific definition of supply chain management. The transportation and storage of raw materials, inventories for work-in-progress, completed items, and the whole order fulfilment process from the point of origin to the site of consumption may all be included in this. Networks, channels, and node firms that are interconnected, interrelated, or linked together provide the goods and services that end users in a supply chain need [1], [2].

An integrated, interdisciplinary, and multimethod approach is what supply chain management aims for. Marketing channels are crucial to supply-chain management. Current research in supply-chain management is focused on, among other things, issues including sustainability, volatility, and risk management. Supply chain resilience is a key idea covered in SCM. Some claim that aspects like as the people dimension of SCM, ethical concerns, internal integration, transparency/visibility, and human capital/talent management have not received enough attention on the research agenda so far.

SCM refers to the wide variety of tasks necessary to efficiently plan, manage, and carry out a product's movement from raw materials to manufacturing and distribution. Demand planning, sourcing, manufacturing, inventory management, and logistics or storage and transportation are among the tasks that largely fall under the umbrella of SCM. SCM includes the integrated planning and execution of operations necessary to optimize the movement of materials, information, and capital. Supply chain management is centered on a more conventional

management and business strategy, while supply chain engineering is focused on a model-based approach, even if both have the same objectives [3].

Mission

Supply chain management approaches, which try to coordinate every aspect of SC from the provision of raw materials to the delivery and resummon of goods, strive to reduce overall costs while taking into account any disputes that may already exist between chain participants. The interaction between the sales department, which wants larger inventory levels to meet demand, and the warehouse, which wants lower stocks to save holding costs, is an example of these tensions.

Definitions and Term History

The phrase supply chain management was first used in a public context in 1982 by Keith Oliver, a consultant at Booz Allen Hamilton, in an interview with the Financial Times. Wolfgang Partech's Supply Chain Management project was executed, and the findings were first published in 1983 in the German publication Wirtschafts Woche. The phrase supply chain management became popular in the middle of the 1990s as a flood of books and articles on the topic were published. Originally, the term supply chain was used to refer to all activities involved in the movement and transformation of commodities from raw materials to the final consumer, as well as information flows related to those operations. The integration of supply chain operations via strengthened linkages throughout the supply chain to gain a competitive advantage was the subsequent definition of supply-chain management. The term supply-chain management (SCM) gained popularity in the late 1990s, and operations managers started using it in their titles more often.

The control of material and information flows between suppliers, businesses, resellers, and end users that have value added both upstream and downstream. To improve the long-term performance of the individual companies and the supply chain as a whole, systematic, strategic coordination of traditional business functions and tactics across all business functions within a specific company and across businesses within the supply chain. Hines offers the following description of a customer-focused company the connections in the supply chain must be seen as a whole system in order for supply chain strategies to be effective in generating customer satisfaction at the point of delivery to the consumer. In order to reduce costs across the chain, needless expenditures, movements, and handling must be eliminated. Efficiency and added value or the end user's perception of value become the primary concerns. Both efficiency and bottlenecks must be eliminated [4].

The effectiveness of the whole system is measured, as well as how fairly people in the supply chain are compensated financially. The supply chain system has to be adaptable to client needs. The alignment of crucial business operations across the supply chain with the aim of benefiting consumers and other stakeholders. The Council of Supply Chain Management Professionals (CSCMP) defines supply-chain management as the organization and control of all sourcing, purchasing, conversion, and logistics-related operations. Additionally, it involves coordinating and working with channel partners, who might be suppliers, middlemen, outside service providers, or clients. Supply-chain management combines the management of supply and demand inside and among businesses. The loosely connected, self-organizing network of companies that collaborate to supply products and services has more recently been referred to as the Extended Enterprise.

DISCUSSION

An organization group that is directly connected by one or more upstream and downstream flows of goods, services, money, or information from a source to a client is referred to as a supply chain, as opposed to supply-chain management. The administration of such a system

is known as supply-chain management. In order to plan production, supply chain visibility was originally concerned with knowing the location, stage of production, and anticipated delivery date of incoming goods and materials. However, as the term has evolved, it can now be used to plan orders using knowledge of potential supplies and to track post-production processes all the way to customer delivery. Tools or modules needed to carry out supply chain transactions, maintain supplier relationships, and regulate related business activities are all included in supply chain management software. By keeping track of a company's whole supply chain network suppliers, transporters, returns, warehouses, retailers, manufacturers, and consumers, the software's ultimate objective is to enhance supply chain performance. In certain instances, a supply chain includes methods for returning broken or undesired items to manufacturers further up the value chain or for collecting things for recycling after customer usage [5].

Functions

A cross-functional strategy called supply-chain management involves controlling the flow of raw materials into an organization, specific internal processes for turning raw materials into completed items, and the flow of finished goods out of the organization and towards the final customer. Organizations are reducing their control of raw material sources and distribution networks as they work to concentrate on their core capabilities and become more adaptable. These tasks are increasingly being delegated to other businesses that can carry them out more efficiently or more affordably. 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 [6]. 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. We must consult with all the suppliers and vendors in this part, do some comparisons, and then place the order.

Importance

Businesses are finding 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 organizational 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, like Dell and Hewlett-Packard, have been able to effectively run collaborative supply networks where each specialized business partner concentrates on only a few critical strategic operations in recent years because to globalization, outsourcing, and information technology. It is possible to recognize this interorganizational supply network as a novel kind of organization. The network structure does not fall into either the market or hierarchy categories, nevertheless, due to the intricate interconnections between the actors. Little is known about the coordination requirements and potential trade-offs that may exist among the actors, and it is unclear what kinds of performance consequences various supply-network topologies may have on businesses.

A complicated network structure may be broken down into its individual component companies from a systems viewpoint. 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 recognized that the choice of an internal management control structure affects the performance of local firms. Supply-chain networks have grown as a result of developments in the corporate environment in the twenty-first century. First, in addition to the preceding just-in-time, lean manufacturing, and agile manufacturing practices, important success factors were discovered as a result of globalization and the growth of multinational corporations, joint ventures, strategic alliances,

and commercial partnerships. Second, improvements in the supply chain network's coordination have been brought about by technical advancements, notably the sharp decline in communication costs a major contributor to transaction costs [7].

By referring to supply network structures as Keiretsu, Extended Enterprise, Virtual Corporation, Global Production Network, and Next Generation Manufacturing System, several scholars have identified them as a new organizational type. Generally speaking, such a structure may be described as a group of semi-independent organizations, each with their own capabilities, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration. The 2019–2020 battle against the coronavirus COVID–19 pandemic that swept the globe highlighted the value of supply chain management. Governments in nations with efficient domestic supply chain management in place had access to enough medical supplies throughout the epidemic to meet their own demands as well as to give any excess to front-line healthcare professionals in other countries [8].

The severe COVID-19 crisis in the US has completely upended several facets of the regional economy, including the illustrious logistics sector. In order to acquire urgently required medical goods, certain organizations were able to swiftly establish overseas supply networks. The 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 ISO/IEC 28000 and ISO/IEC 28001 and associated standards, which were jointly produced by the ISO and the IEC, provide a description of the security-management system for supply chains. Operations management, logistics, purchasing, and information technology are all significantly included into supply-chain management, which aims for an integrated strategy.

Supply-Chain Stability

Supply chain resilience, which is described as the capacity of a supply chain to persist, adapt, or transform in the face of change, is a crucial component of SCM. For a very long time, supply chain management interpreted resilience as engineering resilience, which gave rise to the idea of persistence. Measuring the supply chain's time-to-survive and time-to-recovery allows for the identification of weak places in the system, which is a common application of this concept. The concepts of adaptation and transformation, respectively, have emerged more recently as a result of interpretations of resilience that emphasize ecological resilience and social-ecological resilience. Thus, a supply chain is seen as a social-ecological system that, like an ecosystem like a forest, is capable of adapting to changing environmental conditions on the outside while also having the capacity to transform into a completely new system when social actors are present.

This results in an anarchical interpretation of a supply chain, embedding it within a system of systems and enabling analysis of interconnections between the supply chain and systems operating at other levels such as society, political economy, and planet Earth. These three resilience factors, for instance, might be considered in relation to the 2020 Suez Canal blockage, which lasted for many days due to a ship. Persistence refers to the ability to bounce back; in our case, it refers to the need to rapidly remove the ship in order to resume normal activities. Redirecting ships around the African cape or using alternate forms of transportation may be used to recognize that the system has achieved a new normal condition and behave appropriately. Last but not least, transformation refers to challenging the tenets of globalization, outsourcing, and linear supply chains while imagining alternatives; in this case, this may result in local and circular supply networks that don't need cross-border transportation routes.

Historical Progression

The formation, integration, globalization, specialization phases one and two, and supply-chain management 2.0 are the six main trends that can be seen in the development of these studies. Keith Oliver originally used the phrase supply chain management in 1982. However, in the early 20th century, particularly with the invention of the assembly line, the idea of a supply chain in management was of utmost significance. The necessity for extensive adjustments, re-engineering, downsizing motivated by cost reduction programmers, and widespread attention to Japanese management practices are characteristics of this supply-chain management period. However, the phrase gained popularity when Robert B. Hadfield and Ernest L. Nichols, Jr.'s foundational book Introduction to Supply Chain Management was released in 1999. It sold over 25,000 copies and was also translated into Japanese, Korean, Chinese, and Russian.

With the development of electronic data interchange systems in the 1960s and the advent of enterprise resource planning systems in the 1990s, this period of supply-chain management research was emphasized. With the growth of Internet-based collaborative technologies, this age has continued to advance into the twenty-first century. As the supply chain evolves, value contributed is rising and costs are falling as a result of integration. A network may be categorized as being in stage 1, stage 2, or stage 3. Systems like manufacturing, storage, distribution, and material control are unconnected and independent from one another in a supply chain of stage. Enterprise resource planning is enabled and they are combined into a single plan in a stage supply chain. A supply chain that achieves vertical integration with upstream suppliers and downstream consumers is said to be at stage. Tesco is an example of this sort of supply chain [9].

Age of Globalization

The globalization period, which is the third stage in the history of supply-chain management, may be identified by the focus on global networks of supplier connections and the extension of supply chains beyond national borders and onto other continents. Although the usage of global sources in supply chains of organizations may be traced back many decades for example, in the oil sector, a significant number of organizations did not begin to integrate global sources into their main business until the late 1980s. The globalization of supply-chain management inside organizations with the aim of enhancing their competitive edge, bringing value, and lowering costs via global sourcing characterizes this period. Phase I of the specialization era: outsourced distribution and production Businesses started putting more emphasis on core competencies and specialization in the 1990s. They stopped integrating vertically, offloaded non-core activities, and outsourced those jobs to other businesses.

Due to the supply chain's expansion outside of the company's boundaries and the distribution of management among specialized supply-chain partnerships, new management needs emerged. The essential viewpoints of each organization were also refocused as a result of this transformation. OEMs original equipment manufacturers have evolved into brand owners with a profound need for insight into their supplier chain. Instead of doing it internally, they had to oversee the whole supply chain from the top. Contract manufacturers have to fulfil customer requirements for vendor-managed inventory VMI and work-in-process visibility while managing bills of materials with various part-numbering systems from various OEMs. In order to develop, make, distribute, promote, sell, and support a product, the specialization model establishes production and distribution networks made of several separate supply chains specialized to manufacturers, suppliers, and consumers.

A particular market, location, or channel may have a different set of partners, leading to a proliferation of trade partner settings, each with its own special requirements. Phase II of the specialization era: supply-chain management as a service with the advent of transportation

brokerages, warehouse management storage and inventory, and non-asset-based carriers in the 1980s, the supply chain began to specialize. Today, this specialization extends beyond transportation and logistics to include aspects of supply planning, collaboration, execution, and performance management. In their capacities as elements of supply-chain networks, suppliers, logistics providers, locations, or consumers may sometimes be required to make quick adjustments. The impact of this variation on supply-chain infrastructure is significant, ranging from the fundamental requirements of establishing and managing electronic communication between trading partners to more intricate requirements like the configuration of processes and workflows that are crucial to the management of the network itself.

Similar to how outsourcing manufacturing and distribution has improved overall competencies, supply-chain specialization enables businesses to do the same. It enables them to concentrate on their core competencies and build networks of specific, best-in-class partners to contribute to the overall value chain itself, improving overall performance and efficiency. One of the key reasons why supply-chain specialization is becoming more and more popular is the ability to swiftly acquire and deploy this domain-specific supply-chain knowledge without establishing and maintaining a fully unique and difficult capability in-house. Since its introduction in the late 1990s, outsourced technology hosting for supply-chain solutions has mostly been popular in the areas of transportation and collaboration. From the application service provider model, which was prevalent from about 1998 to 2003, to the on-demand model, which was prevalent from approximately 2003 to 2006, to the software as a service model that is presently in the spotlight.

Social Accountability and Sustainability in Supplier Chains

Networks of supply chains are essential to an economy, but their health depends on how society and the environment are doing. A business concern that affects a company's supply chain or logistics network, supply-chain sustainability is usually measured by comparison to SECH ratings, which use a triple bottom line that takes into account economic, social, and environmental factors. While the acronym ESG stands for Environment, Social, and Governance, SECH scores are described as social, ethical, cultural, and health footprints. Along with non-governmental organizations, consumers are setting the agenda and starting to push for shifts to more sustainable approaches, such as locally produced goods that support independent and small businesses, organically grown foods, anti-sweatshop labor laws, and company ratings that take into account the environmental impact of their purchases.

Many organizations are looking at solutions to lower supply networks' potential contribution to over 75% of a company's carbon footprint in order to raise their profile. For instance, Wal-Mart said in July 2009 that it intended to develop a worldwide sustainability index that would rank items based on the effects that their production and distribution had on the environment and society. The index aims to establish environmental responsibility across Wal-Mart's supply chain and to inspire and set up the necessary framework for other retail businesses to follow suit. According to reports, businesses are increasingly considering environmental performance when choosing suppliers. According to a 2011 poll by the Carbon Trust, 29% of suppliers might be kicked off 'green supply chains' if they do not have sufficient carbon performance histories, and 50% of multinational corporations anticipate making supplier selections based on carbon performance in the future.

In addition to environmental issues, rising globalization in global supply chains raises questions about worker exploitation, forced labor, and modern slavery threats inside multinational organizations. Manufacturing, agriculture, and the textile industry are a few of the sectors with high risks of labor exploitation. Governments, businesses, and NGOs utilize a variety of strategies to stop labor exploitation, such as corporate social responsibility, export restrictions, import bans, and monitoring labor standards. In the guise of the Conflict

Minerals legislation, the US Dodd-Frank Wall Street Reform and Consumer Protection Act, which President Obama signed into law in July 2010, included a supply chain sustainability clause. This law mandates that companies subject to SEC regulation carry out independent audits of their supply chains to ascertain whether any tin, tantalum, tungsten, or gold collectively referred to as conflict minerals is mined or obtained from the Democratic Republic of the Congo.

They also have to produce a report that is made public and available to the SEC outlining the steps they took to conduct due diligence and the audit's findings. It will be required of the chain of vendors and suppliers to these reporting entities to furnish the necessary supporting data. More than 1,100 people were killed in the 2013 Saver building collapse, which sparked a national and international conversation about corporate social responsibility in supply chains. According to Wieland and Hadfield, businesses should audit their goods and suppliers, and supplier audits should extend beyond only first-tier suppliers. Additionally, they show that if supply cannot be directly regulated, visibility must be increased and that smart and electronic technologies are crucial in enhancing visibility. Finally, they emphasize the need of working together with regional partners, companies, and institutions in order to properly manage social responsibility in supply chains.

Supply-chain Management in Circles

To close, slow, intensify, narrow, and dematerialize material and energy loops to minimize resource input into and waste and emission leakage out of the system, improve its operational effectiveness and efficiency, and generate competitive advantage, circular supply-chain management CSCM is defined as the configuration and coordination of the organizational functions marketing, sales, R&D, production, logistics, IT, finance, and customer service within and across business units and organizations. Potential economic and environmental advantages may be attained by limiting resource input and waste leakage throughout the supply chain and configuring it to allow the cycling of resources at various phases of the product or service lifetime. These include things like lower costs for managing materials and trash, as well as lower emissions and resource use.

Supply-Chain Management Power

In order to comprehend how a supply chain relationship functions, buyers and suppliers' power resources, according to Andrew Cox, Joe Sanderson, and Glyn Watson, need be examined. There will be situations when buyers and suppliers may be interdependent or may not have any actual authority over one another. In certain scenarios, a buying business may exert greater control over its suppliers. In other situations, suppliers may have more power. Cox, Sanderson, and Watson have written extensively on how power regimes function in the context of supply chains. Other studies of power in supply chain connections have examined the factors that might affect supply networks' eventual integration.

Whether possible imbalances in inter-firm power within a supply chain may hinder the adoption of efficient supply chain execution was the focus of a 1998 research by Michael Malone and W. C. Benton. Prior to their study, little power research had been reported in the supply chain literature, according to Malone and Benton. They sought to assess the impact of various power techniques on relationships between buyers and sellers, as well as on supply chain performance and satisfaction, using French and Raven's typology of the sources of power in the context of the automobile sector. Their conclusions revealed that coercive and legal/legitimate power bases, which they describe as completely mediated power strategies, led to significant negative relationships, whereas expert and referent power sources lent themselves to significant positive effects on supply chain relationships; reward power had a somewhat positive impact [10].

CONCLUSION

In today's intricate and interrelated business world, supply chain management is essential to an organization's success. Planning, coordinating, and carrying out tasks associated with the movement of products, services, and information from suppliers to clients are all included in this profession. Organizations may gain a competitive edge, improve customer happiness, and maximize operational efficiency with the help of effective supply chain management. The main ideas, difficulties, and approaches related to supply chain management have been covered in this debate. In order to emphasize the need of flawless coordination and information exchange across supply chain partners, we have emphasized the interdependencies among major supply chain components. Recognizing the influence of globalization, technology, and changing consumer expectations, the issues encountered by supply chain managers, such as demand unpredictability, inventory management, and sustainability concerns, have been addressed.

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CHAPTER 2

THE GLOBAL IMPACT: APPLICATIONS AND RESPONSIBILITIES

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ABSTRACT

A comprehensive software programmer created with the goal of streamlining and optimizing supply chain operations on a worldwide scale is known as the global application for supply chain management. It offers features including order administration, warehouse and inventory management, transportation management, analytics and reporting, demand planning and forecasting, and supply chain visibility. With the help of this application, businesses can improve visibility, teamwork, efficiency, and sustainability across their supply chain networks, empowering them to take strategic decisions and manage their supply chain operations.

KEYWORDS:

Business School, Chain Management, Chain Operations, Global, Supply.

INTRODUCTION

Globalization Increased international sourcing Collaboration for value chain segments with budget-friendly suppliers Shared service centers for administrative and logistical tasks Operations are becoming more and more global, necessitating worldwide coordination and planning to attain global optimums. Complex issues increasingly affect midsized businesses as well. Larger lot sizes, reduced taxes, and better conditions such as culture, infrastructure, special tax zones, or advanced OEM for their goods are all made feasible by these changes, which are beneficial to manufacturers in many ways. When supply networks are global in scope, there are several extra difficulties. This is due to the lengthier lead time and increased complexity of a supply chain with a wider reach, including numerous currencies, rules, and legal requirements. Different tax regulations, trade procedures, susceptibility to natural catastrophes and cyber threats, different currencies and values in other nations, and a lack of cost and profit transparency are some of the issues that result [1].

Roles and Obligations

The management and design of supply networks are heavily influenced by supply chain specialists. They assist in deciding whether a product or service is delivered internally by the company insourcing or externally by another company outsourcing while designing supply chains. Supply chain managers coordinate manufacturing across several suppliers to ensure that production and transportation of commodities occur with the least amount of quality control or inventory issues. A successful product construction at a low cost is one of the objectives of a well-maintained supply chain. Such a supply chain may be seen as a firm's competitive advantage. Beyond the construction and upkeep of the actual supply chain, supply chain experts also take part in corporate activities including sales forecasting, quality control, strategy creation, customer service, and systems analysis. An outdated supply chain architecture may become obsolete as a result of changes in a product's production over time. Supply chain specialists must be aware of production and economic developments that influence supply chains and develop backup supply networks if necessary.

The main concerns of supply chain managers were identified in a research project by Michigan State University's Broad College of Business, with input from 50 participating organizations, as being capacityresource availability, talent recruitment, complexity, threats/challenges supply chain risks, compliance, and cost/purchasing issues. It was noted that keeping up with the regular changes in regulation was a significant challenge. Supply Chain Digest and Gartner have both cited supply chain complexity as a recurring difficulty. To evaluate a supply chain's productivity and, ideally, to increase it, supply chain consultants may provide their specialized expertise [2], [3]. The goal of supply chain consulting is to assist management by adding value to the entire process through the various sectors, from the ordering of raw materials to the final product. This is done by sharing knowledge on how to exploit existing assets through improved coordination. In order to address the problem, businesses may either hire external consultants or form internal consulting teams. Businesses pick between the two options while taking into account a variety of criteria.

Employing outside consultants is a standard practice for businesses. The study of the complete supply chain, together with any necessary countermeasures or correctives, is often part of the consulting process as a whole. Supply chain managers must be familiar with managing supply chain processes such transportation, warehousing, inventory control, and production scheduling. Supply chain experts used to place a strong emphasis on logistics abilities including expertise with shipping routes, warehouse equipment, distribution center locations, and footprints, as well as a firm understanding of freight rates and fuel prices. The administration of global supply networks and internal firm-level logistics are now included in supply-chain management. Business continuity principles and tactics must be understood by supply chain specialists.

Certification

By completing an exam created by a third-party certification organization, supply-chain management professionals may get professional certification. A specific degree of subject-matter competence is promised by certification. There are several places where one may learn the information required to pass a certification test. While some information may come from college classes, the majority is learned via a combination of on-the-job training, industry events, networking with colleagues, and reading books and articles in the subject. Workshops for certification that are specific to certain tests may be offered by certification organizations.

College Rankings

The SCM World University 100 ranking, which was released in 2017 and is based on supply chain managers' opinions, places Michigan State University, Penn State University, University of Tennessee, Massachusetts Institute of Technology, Arizona State University, University of Texas at Austin, and Western Michigan University highly for their master's programmers. The following European institutions are highly ranked in the same list: Cambridge University, London Business School, Copenhagen Business School, INSEAD, Canfield School of Management, Valrico Business School, and Eindhoven University of Technology. Massachusetts Institute of Technology, KEDGE Business School, Purdue University, Rotterdam School of Management, Pontifical Universidad Catholic del Peru, Universidad Nova de Lisboan, Vienna University of Economics and Business, and Copenhagen Business School are among the top universities in the 2016 Universal Best Masters Ranking Supply Chain and Logistics [4].

Organizations

The Council of Supply Chain Management Professionals, IIPMR International Institute for Procurement and Market Research, APICS the Association for Operations Management, ISCEA International Supply Chain Education Alliance, and Iosco Institute of Supply Chain

Management are just a few organizations that offer certification in supply chain management. The certifications from APICS and ISCEA are both referred to as Certified Supply Chain Professionals and Certified Supply Chain Managers, respectively. The Chartered Institute of Supply Chain Management also issues a certificate known as Chartered Supply Chain Management Professional. A different one, the Certified Professional in Supply Management focusing on the procurement and sourcing sectors of supply-chain management, is being developed by the Institute for Supply Management. The major certification organization for Canada is the Supply Chain Management Association, and its credentials are recognized internationally. The title of the supply chain leadership credential is Supply Chain Management Professional.

DISCUSSION

One of the key characteristics of contemporary industry is globalization. It increases prospects for organizations in terms of their supplier and consumer bases by bringing the whole globe into a close-knit ecosystem. In fact, managing an organization's supply chain has grown to be its own vertical and is closely related to its primary business. Therefore, it should come as no surprise that supply chain management is a growing job field. The duties of a supply chain management are highly varied since they often face fresh difficulties. Let's examine the subtleties of the position and get into the specifics to address the query, what does a supply chain manager do? All industries depend on supply networks and supply chain management. Getting the resources needed to manufacture products or services and providing them to the consumer under the optimal conditions are the main issues of supply chain management. Understanding what supply chain managers do is essential to how well a company reacts to client demands, which has a direct impact on the bottom line. The movement of value and related information across a network of clients, suppliers, and other stakeholders is overseen by a supply chain manager. Value in this context refers to the key competences of the in-question company, whether it be a product or a service. Typically, supply chain managers work with a variety of internal departments including finance, legal, and production as well as external parties like customers and suppliers [4].

Tools

Global supply-chain management is the process of distributing products and services throughout a network of international businesses in order to increase revenue and reduce waste. Global supply chain management is essentially the same as supply chain management, with an emphasis on transnational businesses and organizations. There are six key areas of focus in global supply-chain management: operations management, supply management, supply chain coordination, competition orientation, customer orientation, and logistics management. These six emphasis areas may be broken down into four basic categories: supply management, operations management, marketing, and logistics. In order to successfully manage a global supply chain, one must also abide by the different rules and guidelines established by various non-governmental organizations, such as The United Nations. Several variables that impose regulations on certain supply chain elements may have an influence on the management of global supply networks.

Governmental and non-governmental organizations are essential in this area because they develop and uphold the rules and laws that businesses must follow. The social concerns such as labor, environmental, etc. that are relevant to the development and operation of a global supply chain are often governed by these regulatory regulations. Companies are required to abide by the rules set out by these regulatory laws, which often have an influence on a company's profitability. There are several risks involved in operating and maintaining a global supply chain. The two primary kinds of these risks are supply-side risk and demand-side risk. A category known as supply-side risk covers dangers related to raw material

availability that affect a company's capacity to meet client needs. Risks related to the availability of the final product fall under the category of demand-side risk. A management may decide to reduce or accept these risks depending on the supply chain. Implementing the right concentration framework, adhering to international laws established by governments and non-governmental organizations, and recognizing and managing the risks involved while maximizing profit and minimizing waste are all necessary for successful global supply-chain management.

Concentration Areas

Global supply chain managers should place a strong emphasis on marketing to increase customer value, satisfaction, and loyalty. Improved profit margins result from increased customer value, contentment, and loyalty, which in turn promotes total business growth. Managers must consider their plans and how they will affect the whole supply chain. The customer perspective approach is one market strategy that is often used by companies with international supply chains. A customer-centric approach to marketing strategy implies putting the consumer first. Understanding the complexity of client values is the main objective from this view point [5]. Understanding how a client forms and develops their values is necessary for this viewpoint. Understanding how a consumer establishes their values enables a business to make adjustments that will appeal to the customer base's values and, in turn, increase profit. Managers who are striving to develop and execute a marketing plan that most closely aligns with client values encounter four typical and significant problems.

In a global supply chain, managers must first overcome the difficulty of precisely identifying what consumer’s value. The problem of determining which supply streams consumers appreciate the most is the main emphasis of understanding customer values in a global supply chain.

Understanding the ongoing shifts in client values throughout global supply chains is the second problem. It is becoming more and harder to remain ahead of the curve and try to foresee shifting values since consumers are continually altering what they value. Delivering values in a context that has never seen this degree of commerce is the third difficulty. Businesses are increasingly using the global market, which presents the problem of trying to provide value in a nation or area that has never been exposed to a marketplace like this. The third and last difficulty is coming up with solutions and maintaining commitment to them. Solutions to these problems have been put into place, but maintaining them is difficult, particularly when firms place more focus on cost-cutting measures.

With a surge in business-to-business worldwide marketing, it is crucial to focus on logistics performance while managing a global supply chain. A worldwide supply chain's logistics are inherently challenging and complicated because of challenges with cross-currency transactions, shipping distances, and trade laws. Companies and/or organizations who priorities logistics management may discover that they have a significant competitive advantage as a result of the influence that it has on consumers. When implementing and administering a company's logistic services, a company has found that focusing on client preferences provides a number of advantages.

Among the main advantages is cost savings. If the business determines all the required logistical segments and then removes unneeded and duplicate ones, costs might be decreased. Customizing logistics not only lowers costs but also boosts sales by luring in a client base that remains loyal to the company. Organizations must create global logistical plans that adequately and successfully address the expectations of the consumer if they want to remain competitive. By doing this, businesses may benefit from the increasingly lucrative worldwide market [6].

Supply Control

Development and management of the vital company and supplier connection are topics covered by supply management. To control the movement of goods and information, several organizations utilize supply chain management software. Oracle, EPCOR, Inform, NetSuite, and IBM are notable firms that provide supply management services. The trend of outsourcing suppliers is being adopted more often as the industry grows more worldwide. A company may gain from outsourcing suppliers in a number of ways if they can successfully manage the relationship. The market for supply chain management was estimated to be worth $18.7 million globally in 2020 and was expected to be worth $52.6 million by 2030. A complete software solution created to simplify and improve supply chain operations on a worldwide scale is the worldwide Supply Chain Management Application. It provides a variety of features and functions that let companies improve supply chain visibility, teamwork, efficiency, and sustainability. This tool enables businesses to manage their supply chains efficiently and make educated choices thanks to real-time data, comprehensive analytics, and simple user interfaces.

Supply Chain Transparency

Real-time tracking this feature allows customers to trace shipments across various locations, modes of transportation, and suppliers in real-time. Inventory management: keeps track of stock locations and levels internationally, enabling companies to optimize stock levels and reduce stock outs. Collaboration with suppliers is made easier by giving a platform for information exchange, order management, and problem resolution. Demand forecasting: Produces precise demand projections using historical data, market trends, and predictive algorithms, helping companies to optimize production and inventory levels. S&OP Sales and Operations Planning integrates sales, marketing, and operational data to balance supply and demand, enabling efficient resource allocation and decision-making. Order Processing: Automates the order management process, guaranteeing effective order processing and reducing mistakes from order placing through fulfilment [7]. Order monitoring: Delivers up-to-the-minute information on order progress, shipment tracking, and delivery alerts, increasing customer satisfaction and lowering queries.

Inventory and Warehouse Management

Optimizes inventory placement, space use, and warehouse layout for effective operations and lower handling expenses. Inventory optimization Aims to reduce excess stock and stock outs by analyzing demand trends, lead times, and carrying costs. Automation of the warehouse: Uses robots, automated systems, and IoT devices to enhance picking, packaging, and fulfilment procedures. Transportation Administration In order to assure timely and economical delivery, carrier selection and routing evaluate carrier performance, choose the best routes, and control transportation expenses. Automating freight invoice audits, expediting payment procedures, and minimizing billing inconsistencies are all achieved via freight audit and payment. Identifying potential for cargo consolidation, improving container utilization, and cutting transportation expenses.

Reporting and Analytics

Performance Metrics Offers key performance indicators (KPIs) dashboards and reports that can be customized to track supply chain performance and pinpoint areas for development. Utilizing cutting-edge algorithms, predictive analytics identifies bottlenecks, anticipates disruptions, and makes proactive decisions possible. Carbon footprint, energy use, and other sustainability indicators are measured and analyzed via sustainability analysis, which supports sustainable supply chain practices. The effective and seamless movement of products and services from suppliers to consumers is made possible by a variety of roles and

responsibilities in supply chain management [8]. Here are some important positions and the duties that go along with them:

Purchasing Manager

1. Create and put into effect supply chain policies, processes, and strategies.
2. Oversee the whole supply chain's activities and guarantee that they are in line with organizational objectives.
3. To satisfy consumer requests while reducing costs, inventory levels should be monitored and optimized.
4. Recognize and reduce supply chain risks, such as delays or interruptions.
5. Work together with vendors, producers, distributors, and other interested parties to build trusting relationships and promote performance enhancements.
6. Analyze supply chain metrics and data to spot problem areas and put the right fixes in place.
7. Ensure that you are adhering to industry standards and legal regulations.

Purchasing Manager

1. Identify and choose suppliers based on price, dependability, and other factors.
2. Obtain favorable price and service agreements by negotiating contracts and conditions with suppliers.
3. Keep an eye on supplier performance and rectify any problems.
4. Maintaining and updating supplier databases with data on contracts, performance indicators, and suppliers.
5. Work with cross-functional teams to comprehend the demands in procurement and create strategies in that regard.
6. To increase efficiency and save costs, always assess and improve your procurement procedures.
7. Keep up with the latest market trends, technological advancements, and procurement best practices.

Logistics Director

1. Plan, coordinate, and streamline the supply chain's flow of commodities.
2. To guarantee prompt and economical delivery, choose the right modes, carriers, and routes for transportation.
3. Manage and follow up on shipments, taking care of the chapterwork, customs clearance, and compliance.
4. Control the activities of the warehouse and the distribution center, including the receiving, storing, picking, and packaging.
5. To maximize space utilization and save expenses, optimize inventory levels and warehouse layout.
6. Negotiate contracts while establishing and maintaining connections with logistical service suppliers.
7. Implement and deploy warehouse and transportation management systems to increase visibility and efficiency.

Demand Forecaster

1. To predict future demand, analyses previous sales data, market trends, and consumer insights.
2. Work together to verify demand predictions by soliciting feedback from the sales, marketing, and operations departments.
3. In order to reduce stock outs and surplus inventory, projections are continually monitored and analyzed for demand trends.

4. Work together with the manufacturing teams, suppliers, and forecasters to match supply with demand.
5. To analyses projections, identify risks, and establish mitigation techniques, hold demand planning sessions.
6. Use demand planning tools and technologies to provide precise and timely forecasts.

Inventory Supervisor

1. Reduce carrying expenses and stock outs while optimizing inventory levels to match client demand.
2. To establish the proper safety stock levels, analyses demand and assess prediction accuracy.
3. Work together to assure inventory availability and accuracy with the procurement, manufacturing, and sales teams.
4. Implement inventory management strategies including just-in-time (JIT) principles, ABC analysis, and cycle counting.
5. Metrics of inventory performance include turnover, holding costs, and service levels should be tracked and analyzed.
6. Find and fix slow-moving inventory, obsolescence, and inventory inconsistencies.

Elements of Management

The third part of the four-square circulation structure is made up of SCM component. The amount and quality of components added to a business process connection determine its degree of integration and management. Therefore, raising the degree of each management component or adding additional may raise the level of integration of the business process link. Literature on SCM, buyer-supplier relationships, business process reengineering, and buyer-supplier relationships when managing supplier partnerships, proposes a number of potential components that should be given management attention [9].

The following elements were recognized by Lambert and Cooper

1. Control and preparation.
2. Work organization.
3. Organizational design.
4. Structure of the product flow facility.
5. Structure of the information flow facility.
6. Management strategies.
7. Structure of leadership and power.
8. Structure of reward and risk.
9. Culture and mentality.

However, a more thorough analysis of the existing literature results in a more thorough understanding of what should be the most important supply chain components, or branches, of the previously identified supply chain business processes specifically, what kind of relationships the components may have with suppliers and customers. According to Bowers ox and Closes, the focus on collaboration symbolizes the synergism that results in the maximum degree of collaborative success. A company that accepts responsibility for inventory ownership or other financial risks, so incorporating primary level components, is referred to as a primary-level channel participant. A company that engages in channel connections as a secondary-level participant specialized provides necessary services for primary participants, such as secondary level components that assist primary participants.

It is also possible to incorporate third-level channel participants and components that assist main-level channel participants and serve as the principal branches of secondary-level components. Therefore, Lambert and Cooper's framework of supply chain components fails

to reach any conclusions regarding which supply chain components should be viewed as primary or secondary, how these components should be organized to achieve a more comprehensive supply chain structure, or how to examine the supply chain as an integrative one.

Supply-Chain Management Power

In order to comprehend how a supply chain relationship functions, buyers and suppliers' power resources, according to Andrew Cox, Joe Sanderson, and Glyn Watson, need be examined. There will be situations when buyers and suppliers may be interdependent or may not have any actual authority over one another. In certain scenarios, a buying business may exert greater control over its suppliers. In other situations, suppliers may have more power. Cox, Sanderson, and Watson have written extensively on how power regimes function in the context of supply chains. Other studies of power in supply chain connections have examined the factors that might affect supply networks' eventual integration [10]. Whether possible imbalances in inter-firm power within a supply chain may hinder the adoption of efficient supply chain execution was the focus of a 1998 research by Michael Malone and W. C. Benton. Prior to their study, little power research had been reported in the supply chain literature, according to Malone and Benton. They sought to assess the impact of various power techniques on relationships between buyers and sellers, as well as on supply chain performance and satisfaction, using French and Raven's typology of the sources of power in the context of the automobile sector.

CONCLUSION

Businesses may optimize their supply chain operations on a worldwide scale with the help of the global application for supply chain management. Organizations may improve collaboration, efficiency, and sustainability throughout their supply chain networks by utilizing capabilities like supply chain visibility, demand planning, order management, and analytics. In the complicated and linked business environment of today, this application enables firms to take well-informed decisions, reduce risks, and achieve supply chain excellence. The duties and responsibilities within supply chain management are also quite important in maintaining the efficient operation of the supply chain. Each function has a part in the overall success of the supply chain, from the procurement manager who sources suppliers and negotiates contracts to the supply chain manager who oversees operations and manages risks.

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CHAPTER 3

COMPONENTS OF THE SUPPLY CHAIN MANAGEMENT

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ABSTRACT:

Planning, coordinating, and controlling the complete flow of goods, services, and information from the procurement of raw materials through the delivery of finished items to end customers is the scope of the crucial discipline known as supply chain management. In order to produce and provide value to customers, a network of organizations, procedures, and resources must collaborate. By controlling costs and maximizing customer satisfaction, effective supply chain management makes sure that goods or services are delivered to the appropriate location at the appropriate time and in the appropriate amount. The following are important elements of supply chain management: production, logistics, and customer service.

KEYWORDS:

Chain Management, Customer Service, Goods Service, Product Design, Supply Chain,

INTRODUCTION

A supply chain, commonly written as supply-chain is a complicated logistics system made up of facilities that turn raw materials into finished goods and then deliver them to end users or end clients. In the meantime, supply chain management optimizes the movement of items along the supply chain. Used goods can re-enter the supply chain at any point where there is recyclable residual value in complex supply chain systems. Linking value chains are supply chains. In a supply chain, suppliers are frequently ranked according to tier, with first-tier suppliers providing goods directly to customers, second-tier suppliers providing goods to the first tier, and so on. A chain is essentially a highly intricate and dynamic network of supply and demand. Two stages, called the production stage and the distribution stage, can be found in a typical supply chain. In the production phase, manufacturing facilities create components and partially finished items [1]. The pieces are then assembled in an assembly line. Central and local distribution hubs convey goods to final consumers during the distribution stage.

Materials and finished goods only move to the end of the supply chain because of the actions of the customers there. According to academics Alan Harrison and Janet God sell, supply chain processes should be coordinated to focus on end customer buying behavior, and they use customer responsiveness as a sign that materials can move through a sequence of supply chain processes in order to meet end customer buying needs. Many of the interactions that occur in the supply chain are between various businesses that want to maximize their profits in their respective industries, but may know little to nothing about or care about the other participants in the supply chain. The loosely coupled, self-organizing network of companies that collaborate to offer goods and services has more recently been referred to as the extended enterprise, and the term chain and the apparent linear structure it denotes have come under fire for being harder to relate to the way supply networks really operate.

A chain is essentially a highly intricate and dynamic network of supply and demand. Many major corporations and international brands are incorporating codes of conduct and guidelines into their corporate cultures and management systems as part of their efforts to exhibit ethical behavior. These enable organizations to impose requirements on their supplier's facilities, farms, subcontracted services like cleaning, canteen, security, etc. and

confirm through social audits that they are adhering to the necessary standard. Lack of supply chain transparency might prevent customers from knowing where their goods came from and encourage unethical behavior. In a poll conducted in 2018, the Supply and Value Chain Centre at Loyola University Chicago discovered that 53% of supply chain professionals said ethics were extremely essential to their organization [2], [3].

Typologies

In a significant chapter from 1977, Marshall L. Fisher poses the query, which is the right supply chain for your product? Fisher, as well as Naylor, Naima, and Berry, highlight two complementary traits of a successful supply chain strategy: the ability to combine functional and efficient elements, or the ability to combine responsive and innovative elements Harrison and God sell. According to Brown et al., supply chains can be either loosely coupled or tightly coupled. Leading businesses are switching from tightly coupled to loosely coupled processes to increase their flexibility and profitability. These concepts speak of two opposing polar models of collaboration: tightly coupled, or hard-wired, also known as linked, collaboration denotes a close relationship between a buyer and supplier within the chain, whereas a loosely-coupled link refers to low interdependency between buyer and seller and, consequently, greater flexibility. According to the expert advice provided by the Chartered Institute of Procurement & Supply, the purpose of a tightly connected connection is to decrease inventory and prevent stock-outs.

Modeling

A supply chain flowchart. The grey arrow denotes the flow of information and backhauls, whereas the black arrow denotes the flow of information and materials. The components are the original supply vendor or plant, a supplier, a manufacturer manufacturing, a customer, and a final customer. Different supply-chain models exist that take into account both the upstream and downstream components of supply-chain management SCM. The SCOR Supply-Chain Operations Reference model, created by a partnership between business and the nonprofit Supply Chain Council now a part of APICS, became the de facto standard for supply-chain management across industries. SCOR gauges the efficiency of the entire supply chain. It is a process reference model for managing the supply chain, starting with the supplier and ending with the client. In assessing the overall effective performance of a supply chain, it takes into account performance in terms of delivery and order fulfilment, production flexibility, warranty and returns processing costs, inventory and asset turnovers, among other things.

The initial phases of a supply chain, like raw material processing and manufacturing, establish their break-even point by taking production costs into account compared to market pricing. A supply chain can frequently be divided into distinct segments. Consideration of transaction costs in relation to market pricing helps identify the break-even point for later stages of a supply chain, such as wholesale and retail. Each stage of a supply chain model has corresponding expenses in terms of money. An alternate supply chain model has been introduced by the Global Supply Chain Forum. Eight important business operations that cross both functional and organizational boundaries serve as the foundation of this system [4]. A cross-functional team that includes members from logistics, production, purchasing, finance, marketing, and research and development oversees each step. The processes of customer relationship management and supplier relationship management make up the crucial supply chain links, even though each one interacts with important customers and suppliers.

A high-level, industry-neutral enterprise process model called the Process Classification Framework (PCF) SM by the American Productivity and Quality Centre (APQC) enables organizations to analyses their business processes from a cross-industry perspective. Regardless of industry, size, or location, APQC and its member organizations designed the

PCF as an open standard to enable improvement through process management and benchmarking. Over 1,000 processes and related activities are categorized into 12 enterprise-level categories by the PCF, which also includes process groups. John Snow, Inc. has created the JSI Framework for Integrated Supply Chain Management in Public Health, which draws on industry best practices to address issues with public health supply chains in the context of developing countries.

DISCUSSION

75 tons of recyclable chapter are sent daily to a German chapter industry as its raw material. The term supply-chain management, which refers to the integration of important business operations from end users through original suppliers, was created in the 1980s. Original suppliers are people who offer goods, services, and knowledge that benefit clients and other parties involved. The fundamental tenet of SCM is that businesses and corporations participate in a supply chain by exchanging data on consumer demand, supply chain capacity, and manufacturing capacities. The phrase was coined in 1982 by Keith Oliver, a consultant at Booz Allen Hamilton, after he used it in an interview with the Financial Times. The phrase was first used by Burns and Sivazlian in 1978 and Aliza Mir et al. in 1981. Every company in the supply chain has the ability to contribute to the optimization of the entire supply chain as opposed to sub-optimizing based on local optimization if all relevant information is available to any relevant company.

This will result in improved overall manufacturing and distribution planning, which can save costs and produce a more appealing final product, boosting sales and improving overall performance for the companies involved. One example of vertical integration is this [5]. However, research has revealed that the reasons for vertical integration and its effectiveness in terms of performance vary by geographical location. Successfully integrating SCM results in a new type of rivalry on the global market, one that is supply-chain-versus-supply-chain-based rather than company-versus-company-based. Many electronics businesses in Guangdong and elsewhere rely on Shenzhen's many component stores for their supply of parts.

SCM's main goal is to satisfy consumer expectations by making the most effective use of available resources, such as labor, inventory, and distribution capacity. Theoretically, a supply chain aims to minimize inventory while balancing supply and demand. Working with suppliers to remove bottlenecks, strategic sourcing to balance lowest material cost and transportation, implementing just-in-time manufacturing techniques, maintaining the right mix and location of factories and warehouses to serve customer markets, and using location allocation, vehicle routing analysis, dynamic programming, and traditional logistics optimization are just a few of the aspects of improving the supply chain.

The term logistics refers to operations involving the distribution of products within a single business or organization, whereas supply chain also includes manufacturing and procurement and, as a result, has a much broader focus since it entails multiple businesses such as suppliers, manufacturers, and retailers cooperating to satisfy a customer's need for a good or service. Beginning in the 1990s, a number of businesses decided to engage with a third-party logistics provider 3PL in order to outsource the logistical component of supply-chain management. Contract manufacturers are also used by businesses to outsource production. To fulfil the demand for assistance in managing these intricate systems, technology businesses have emerged [6]. Due to their influence on the optimization of time, resources, and inventory visibility, cloud-based SCM solutions are at the forefront of next-generation supply chains. The problem of inventory located in locations without online coverage or connectivity is frequently resolved by the use of cloud technologies, which enable work to be processed offline through a mobile app.

Performance

Supply chain managers are constantly under pressure to negotiate the best prices for their resources, which is challenging given the inherent lack of transparency. More information required Cost benchmarking aids in locating competitive pricing within the sector, but it has been suggested that the optimum practice is to benchmark a variety of supply chain performance variables. More than 150 important indicators that measure the performance of supply chain activities are included in the SCOR model: reference for supply chain operations measurements of performance. Measuring supply chain performance is not a novel practice, according to Debra Hoffman. Today, the majority of businesses assess at least some elements of their supply chain and are aware of the need for a more thorough measurement programmer. Supply chain managers, however, view the variety of available prospective performance measurements as a challenge.

In order to more clearly show interdependencies and the contribution of many indicators to the key or most important metrics, one method is to connect several measures in a hierarchical framework. According to Hoffman, the following three factors are indicative of a successful supply chain: The discrepancy if any between predicted and actual demand is referred to as demand forecast accuracy. The most important aspect and leading indicator of successful delivery along the chain is a supply chain's capacity to respond to customer demand. Orders that are fully accurate, timely, and in great condition are what we consider to be ideal order fulfilment. Costs associated with the entire supply chain, including sourcing, manufacture, distribution, and customer support. According to a boardroom study conducted by Canfield University in 2010, many firms understood the value of the supply chain's contribution to their company's success, with cost, customer lead-time, and customer quality as the key performance factors.

Resilience

The ability of a supply chain to endure, adapt, or transform in the face of change is known as supply chain resilience. For a very long time, supply chain management interpreted resilience as engineering resilience or robustness, which gave rise to the idea of persistence. One common way to put this concept into practice is to calculate the supply chain's time-to-survive and time-to-recovery, which enables the detection of weak places in the system. The concepts of adaptation and transformation, respectively, have emerged more recently as a result of interpretations of resilience that emphasize ecological resilience and social-ecological resilience. Thus, a supply chain is seen as a social-ecological system that, like an ecosystem like a forest, can adapt to changing environmental conditions over time and, with the help of social actors and their ability to foresee the future, can also completely transform into a new system. This results in an anarchical interpretation of a supply chain, embedding it into a system of systems and enabling analysis of interconnections between the supply chain and systems operating at other levels such as society, political economy, and planet Earth.

These three resilience factors can be seen, for instance, in relation to the 2021 Suez Canal obstruction, which occurred when a ship stopped the canal for several days. Persistence refers to the ability to bounce back; in our case, it refers to the need to rapidly remove the ship in order to resume normal activities [7]. Redirecting ships around the African cape or using alternate forms of transportation can be used to recognize that the system has achieved a new normal condition and act appropriately. Finally, transformation refers to challenging the tenets of globalization, outsourcing, and linear supply chains while imagining alternatives, such as local and circular supply chains in this case. Resilience of the supply chain has been recognized as a crucial business concern. A substantial number of companies had relocated portions of their supply chains to European countries, according to a 2014 report by the

Confederation of British Industry in the United Kingdom. Many of these companies cited supply chain resilience as a key factor in their decision to do so.

Obligation to Society

More than 1,100 people were killed in the 2013 Saver building collapse, which sparked a national and international conversation about corporate social responsibility in supply chains. According to Wieland and Hadfield, businesses should audit their products and suppliers, and supplier audits should extend beyond first-tier suppliers those who directly provide the primary consumer. They also show that, if the supply cannot be directly managed, visibility must be increased and that smart and electronic technologies are crucial in enhancing visibility. Finally, they emphasize the importance of working together with regional partners, companies, and institutions in order to properly manage social responsibility in supply chains. This tragedy underlines the necessity of raising workplace safety standards. Hoi and Lin point out that corporate social responsibility can have an impact on the adoption of laws that can enhance workplace safety and health administration in businesses. International organizations that operate in other countries are actually obligated to make sure that workplace policies adequately protect employees in order to prevent accidents.

Supply-chain-Affecting Trends

Informational supplement network of supply chains Because of today's markets' increased globalization and simpler access to other alternatives, product design's role in creating demand is more important than ever. Additionally, when supply grows and, consequently, so does rivalry among businesses for the small market demand, and as pricing and other marketing components lose their distinctiveness, product design also plays a different function by offering desirable qualities to spur demand. Demand generation in this context refers to the ability of a product design to generate demand [8], [9]. In other terms, it refers to a product's capacity to raise demand by exceeding consumer expectations. But in addition to influencing demand generation, product design also has an impact on cost, lead time, quality, and manufacturing procedures. Manufacturing, transportation, quality, quantity, production schedule, material choice, production technology, production rules, regulations, and laws are all directly impacted by the product design, as well as the connected supply chain and its requirements.

In general, the design of the product and the capabilities of the supply chain influence the success of the supply chain. However, the opposite is also true: the success of the product is influenced by the supply chain that produces it. An industrial engineering study that examined the Design for Supply Chain (DFSC) process found that because the product design places numerous demands on the supply chain, once it is finished, it determines the structure of the chain, restricting engineers' ability to come up with and assess alternative, potentially more cost-effective supply chains. Design for Supply Chain is described as a process that strives to significantly lower product life cycle costs, enhance product quality, increase productivity, and increase profitability for all supply chain stakeholders.

Anthony Tarantino, a supply chain consultant, has identified several best practices that have an impact on the robustness and functionality of supply chains. These include the creation of multidisciplinary centers of excellence, hybrid supply chain organizations that optimize the balance between centralization and de-centralization, and greater use of both structured and unstructured data. Supply chain management is increasingly using big data, particularly in the area of strategic purchasing and supply management. Through better decision-making abilities, effective implementation of big data can enhance the performance of supply chain activities. Supply chain cooperation is frequently viewed by players as one of the value-adding activities in a value chain due to the increased complexity and b2b activity brought on by economic expansion.

Duties Fall Under Supply Chain Management

The smooth and effective operation of the supply chain depends on the effective and efficient administration of a wide range of tasks. The following are some of the main duties of supply chain management: Supply chain managers are in charge of demand planning and forecasting. To accurately predict future demand, they must examine historical data, market trends, and consumer insights. They work together with the sales, marketing, and operations teams to balance supply and demand and to achieve the ideal level of inventory. The sourcing, selection, and management of suppliers fall under the purview of supply chain managers. While upholding quality standards, they negotiate contracts, assess supplier performance, and guarantee prompt delivery of goods and services.

Inventory Management: Supply chain managers keep an eye on stock levels and make sure they are at the ideal level to satisfy demand from customers. In order to minimize stock outs, save carrying costs, and manage obsolescence, they adopt inventory control procedures. Supply chain managers coordinate the movement of items along the supply chain through logistics and transportation. To ensure prompt and affordable delivery, they choose the best transportation options, bargain with carriers, plan the best course of action, and oversee logistics operations.

Distribution and Warehousing: Supply chain managers are in charge of picking, packaging, shipping, and all other aspects of warehouse operations. They establish effective inventory management procedures and optimism warehouse layouts and space utilization.

Supply Chain Visibility and Collaboration: Supply chain managers work to improve supply chain visibility by putting in place procedures and systems that give customers up-to-the-minute data on stock levels, shipping status, and supplier performance. To boost communication and speed up problem resolution, they encourage collaboration with suppliers, distributors, and other stakeholders. Supply chain managers detect and reduce risks, such as supplier interruptions, natural disasters, or geopolitical difficulties that could cause supply chain disruptions. They create backup plans, arrange alternative sourcing plans, and put policies in place to guarantee company continuity.

Key performance indicators (KPIs) are defined by supply chain managers to assess performance and make improvements. They perform data analysis, pinpoint problem areas, and put strategies into place to boost productivity, cut expenses, and improve client happiness. Supply chain managers are increasingly in charge of encouraging ethical and sustainable practices throughout the supply chain. This entails assuring eco-friendly operations, ethical sourcing, respect for workers' rights, and adherence to legal standards. Supply chain managers spearhead continuous improvement projects to find and put into practice cutting-edge solutions and best practices. To improve supply chain operations, they keep up with market advancements, emerging technology, and industry trends.

Advantages

Numerous benefits that supply chain management offers help firms succeed and remain competitive. Among the main benefits of supply chain management are:

Cost Effectiveness: Companies can optimism their operations and lower costs across the whole supply chain with effective supply chain management. In order to achieve favorable pricing and terms with suppliers, this involves reducing inventory carrying costs, maximizing transportation and logistics costs, and streamlining procurement processes. Businesses can reduce costs and increase profitability by streamlining procedures and removing waste. Supply chain management gives companies the opportunity to improve customer happiness and service. Businesses may guarantee product availability, lower stock outs, and increase order fulfilment rates by optimizing inventory levels. Additionally, timely and precise

deliveries are made possible by effective logistics and transportation operations, which reduce lead times and boost customer response. Providing better customer service can enhance customer loyalty and customer retention rates.

Increased Operational Efficiency: The main goals of supply chain management are process optimization, bottleneck elimination, and increased operational efficiency. Businesses can decrease cycle times, boost production, and increase throughput by implementing lean principles and continuous improvement techniques. Organizations can respond rapidly to shifting market needs and gain a competitive advantage by streamlining their operations.

Enhanced Collaboration and Communication: Collaboration and communication amongst supply chain stakeholders are encouraged by effective supply chain management. Customers, manufacturers, distributors, and suppliers all fall under this category [10]. Businesses may increase visibility, lessen uncertainty, and improve decision-making by exchanging information, coordinating tasks, and aligning goals. Better demand and supply coordination is made possible by collaborative connections, which boosts the responsiveness and efficiency of the supply chain. Risk identification and mitigation are key components of supply chain management because they prevent disruptions in the flow of products and services. Businesses may increase their resilience and lessen the effects of disruptions like natural disasters, supplier failures, or geopolitical events by diversifying their suppliers, putting contingency plans in place, and developing alternate sourcing strategies. Organizations may sustain business continuity and guarantee uninterrupted supply chain operations by implementing proactive risk management techniques.

Strategic Advantage: A well-managed supply chain can give companies a competitive edge. It lets businesses to stand out from the competition in the market by offering better customer service, quicker time to market, and cutting-edge supply chain techniques. Long-term sustainability, greater market share, and enhanced brand reputation can all be attributed to a well-optimized supply chain.

Sustainability and Social Responsibility: The promotion of sustainable and socially responsible practices is made possible in large part by supply chain management. Businesses can conform to customer preferences, legal needs, and society expectations by integrating environmental considerations, ethical sourcing, and fair labor practices into supply chain operations. Sustainable supply chain practices not only improve a company's reputation but also cut costs by utilizing resources more effectively, reducing waste, and saving energy.

CONCLUSION

Supply chain management is crucial to the performance and long-term viability of firms in all sectors. It includes a variety of tasks aimed at ensuring the smooth flow of products, services, and information, such as production, logistics, and customer service. Organizations can efficiently meet consumer requests, lower costs, increase customer happiness, and gain a competitive advantage in the market by having a well-managed supply chain. Globalization, technological improvements, and shifting consumer expectations have all contributed to a major rise in supply chain complexity. As a result, companies need to adopt strategic methods to manage their supply chains efficiently. Process optimization, working with partners and suppliers, utilizing data and analytics, and adopting sustainable principles are all necessary to achieve this.

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CHAPTER 4

OBJECTIVE AND IMPORTANCE OF SUPPLY CHAIN MANAGEMENT

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ABSTRACT:

Supply chain management, approaches aimed at coordinating all aspects of Supply chain , from raw material supply to product delivery and resumption, attempts to reduce overall costs in relation to existing disputes among chain members. Across all industries, supply chain management is essential to the success and long-term viability of enterprises. It entails the organization, coordination, and management of the flow of supplies, services, and information to clients. In order to optimism operations, cut costs, improve customer service, and create competitive advantage, supply chain management is crucial. Businesses can enhance order fulfilment rates, reduce inventory carrying costs, streamline procedures, and save money by managing the supply chain correctly.

KEYWORDS:

Design, Planning, Retail, Supply Chain, Surplus.

INTRODUCTION

Every supply chain should aim to maximize the value that is created overall. The value that a supply chain creates, often referred to as supply chain surplus, is the difference between the finished product's value to the customer and the costs that the supply chain incurred in order to fulfil the customer's request. Customer Value minus Supply Chain Cost Equals Supply Chain Surplus Each consumer will have a different opinion of the finished product's value, which can be gauged by the highest price the customer is prepared to pay. The buyer keeps the difference between the product's worth and price called consumer surplus. The remaining supply chain excess is transformed into supply chain profitability, which is the difference between customer revenue and the total cost of the supply chain. As an illustration, the $60 a customer spends at Best Buy on a wireless router symbolizes the profit the supply chain makes. Customers that buy the router do so because they believe it is worth at least $60. As a result, a portion of the supply chain surplus is left over as consumer surplus with the client. The remainder is retained by the supply chain as profit.

Costs are incurred by Best Buy and other parts of the supply chain when information is transmitted, components are produced, stored, transported, money is transferred [1]. The profitability of the supply chain is defined as the difference between the $60 the client paid and the total costs expended by it to make and distribute the router. The overall profit that will be split among all supply chain intermediates and stages is known as supply chain profitability. The supply chain is more successful the greater its profitability rate. The supply chain surplus will be closely connected with earnings for the majority of supply chains that generate profits. Success in a supply chain should be evaluated in terms of overall profitability rather than earnings at specific stages. In later chapters, we show that an emphasis on individual stage profitability may result in a decline in supply chain earnings overall. All supply chain participants are pushed to increase the size of the total pie when the supply chain excess is the primary focus. The next logical step after defining a supply chain's success in terms of supply chain profitability is to seek for sources of value, revenue, and cost.

There is just one revenue source for any supply chain: the customer. The value a customer receives while purchasing detergent at Wal-Mart relies on a number of variables, including the detergent's functionality, the distance the customer must travel to Wal-Mart, and the possibility that the detergent will be in stock. The only source of positive cash flow for the Wal-Mart supply chain is the customer. Given that separate stages have different owners, all other cash flows are just fund exchanges that take place inside the supply chain. When Wal-Mart pays a supplier, it deducts a sum from the funds the client supplies and gives it to the supplier. Costs are created inside the supply chain by any flows of information, goods, or money. Therefore, effective management of these flows is essential for the success of the supply chain. In order to maximize overall supply network surplus, effective supply chain management entails managing the assets, products, information, and cash flows.

An increase in supply chain excess expands the overall pie, which benefits the supply chain's contributors. In this book, we put a lot of emphasis on examining how each supply chain choice affects the supply chain excess. There are many different factors that can affect these choices and their effects. For instance, take a look at how the supply chains for fast-moving consumer items differ between India and the United States. In comparison to their Indian counterparts, U.S. distributors have a significantly lower impact on this supply chain. We contend that the effect a distributor has on the supply chain surplus in the two nations can account for the variation in supply chain structure [2], [3]. The retail industry in the US is largely concentrated, with huge chains acquiring consumer goods from the majority of producers. Because of the scale that this consolidation has given retailers, using an intermediary like a distributor has minimal effect on lowering costs and can even increase them as a result of an additional transaction. India, in comparison, has millions of modest retail establishments. An order can be compared to the weekly grocery shopping for a family in the United States because of how little inventory Indian retail stores can hold due to their small size.

Bringing huge truckloads of product near to the market and then distributing locally using milk runs with smaller trucks are the only ways for a producer to keep transportation costs low. If transportation expenses are to be kept to a minimum, having an intermediate who can receive a big truckload supply, break bulk and then make smaller deliveries to the merchants is essential. The majority of distributors in India are one-stop stores that provide everything from cooking oil to soaps and detergents made by different producers. In addition to the ease of one-stop shopping, distributors in India can save transportation costs for outbound delivery to the merchant by combining products from many manufacturers during delivery runs. Because their cost of collection is substantially lower than what it would be if each manufacturer collected from shops on its own in India, distributors also handle collections. As a result, the expansion of supply chain surplus brought on by distributor presence in India can be used to explain the significance of distributors in that country. According to the supply chain excess thesis, distributors' importance will decrease as Indian retailing starts to consolidate.

DISCUSSION

The performance of a supply chain is closely related to how the flows of product, information, and money are designed and managed. Examples of businesses that have based their success on better supply chain design, planning, and management include Wal-Mart, Amazon, and Seven-Eleven Japan. On the other hand, flaws in the planning and architecture of their supply chains can be blamed for the demise of numerous internet enterprises, like Web van. The emergence and subsequent demise of Borders, a chain of bookstores, serves as an example of how performance was negatively impacted by the supply chain's inability to adjust to a changing market and customer expectations. Another business that had to alter its supply chain strategy in response to evolving technology and customer demands is Dell

Computer. In the section that follows, we talk about these instances. Wal-Mart has been a pioneer in the successful use of supply chain design, planning, and operation. To ensure the efficient flow of goods and information, the corporation made significant early investments in the infrastructure of transportation and information. In order to enable frequent replenishment at its retail outlets while minimizing costs, Wal-Mart built its supply chain with store clusters centered on distribution centers. Stores can better balance supply and demand thanks to frequent replenishment than their rivals [3].

Wal-Mart has been a pioneer in information sharing and supplier collaboration to reduce costs and increase product availability. The outcomes are outstanding. The business reported a net income of more than $14.3 billion on revenues of over $408 billion in its 2010 annual report. These are remarkable outcomes for a business that in 1980 only had yearly sales of $1 billion. The increase in sales reflects a compound annual growth rate of more than 20%. Another business that has successfully leveraged superior supply chain design, planning, and execution to promote growth and profitability is Seven-Eleven Japan. It has employed an excellent information system and a very quick replenishment system to make sure that the right products are available at each of its convenience stores to meet the needs of the customers. Because of its responsiveness, it may adjust the mix of merchandise at each location based on the time of day to precisely meet customer demand. The corporation has expanded as a result, increasing its revenues from 1 billion yen in 1974 to approximately 3 trillion yen in 2009, with earnings of 164 billion yen.

The failure of numerous internet businesses, like Web van and Cosmo, can be ascribed to their inability to successfully manage supply chain flows or create suitable supply chains. Groceries were delivered to consumers' homes from big warehouses that Web van developed in a number of significant American cities. In terms of cost, this supply chain design was unable to compete with the supply chains used by conventional supermarkets. Traditional supermarket chains use whole truckloads to deliver items to a supermarket near to the customer, which results in very low transportation costs. They allow the customer to pick the majority of the items in the store and turn their inventory around very quickly. While Web van's inventory turned slightly more quickly than that of supermarkets, it did so at the expense of substantially higher home delivery transportation and labor expenses. As a result, the business failed in 2001, just two years after making a very successful initial public offering.

The experience of Borders shows how performance can be severely harmed by a failure to adjust supply networks to a changing environment. By embracing the superstore concept, Borders and Barnes & Noble controlled the book and music industry in the 1990s. Borders was able to provide clients with a wider selection about 100,000 titles at superstores compared to less than 10,000 titles at a local bookshop at a cheaper price point than the small local bookstores that had previously dominated the market. Due to cheaper operational costs per dollar of sales, the company was able to shift its inventory over more frequently than neighborhood book stores. Borders had earnings of $132 million and sales of approximately $4 billion in 2004 [4]. However, the rise of Amazon, which offered a much wider selection than Borders at a lower price by selling online and keeping its inventories in a few distribution centers, already posed a threat to its business model. Borders' quick decline was caused by its inability to modify its supply chain in order to compete with Amazon. Sales had fallen to $2.8 billion by 2009, and the business lost $109 million that year.

Dell is another example of a business that achieved great success thanks to the design, planning, and execution of its supply chain but later had to modify it in reaction to changes in technology and customer expectations. Because of the way its supply chain was set up, Dell saw an unheard-of increase in both revenue and profitability between 1993 and 2006, enabling it to swiftly and affordably provide customized PCs to clients. On sales of little over

$56 billion, Dell earned a net income of more than $3.5 billion by 2006. Two essential supply chain elements that supported quick, affordable customization were the foundation of this success. The first was Dell's choice to forego wholesalers and retailers and sell directly to consumers. The second crucial element of Dell's supply chain was the concentration of production and stock in a small number of locations, with final assembly deferred until the receipt of the client order. Due to low levels of component stocks, Dell was able to provide a wide range of PC configurations.

Despite this outstanding accomplishment, Dell faced several fresh obstacles as the market evolved. The market transitioned to lower levels of customization whereas Dell's supply chain was best suited for highly customized PCs. Customers were content with a small number of model varieties given the expanding power of hardware. In response, Dell made changes to its supply chain that affected both direct selling and constructing to order. The company began selling its personal computers through retail giants including Wal-Mart in the US and GOME in China. Additionally, a significant portion of its assembly was outsourced to low-cost regions, effectively producing goods based on inventory rather than client orders. In contrast to Borders, Dell is investing heavily in modernizing its supply chain. It has yet to be seen whether these adjustments will boost Dell's efficiency. In the next section, we categories supply chain decision phases according to how frequently they are made and how much time they account for.

A Supply Chain's Decision Phases

Numerous choices must be made in order to manage the flow of information, goods, and money successfully in a supply chain. Every choice should be made with the supply chain surplus in mind. Depending on the frequency of each decision and the time period during which a decision phase has an impact, these decisions can be divided into three groups or phases. Each category of decision must therefore take uncertainty throughout the decision horizon into account.

1. **Supply Chain Design or Strategy:** A company makes decisions on how the supply chain will be organized over the coming years during this phase. It determines the configuration of the chain, the distribution of resources, and the operations carried out at each stage. Companies must make strategic decisions regarding whether to outsource or handle certain supply chain tasks internally, the location and size of production and storage facilities, the products to be produced or stored at various locations, the modes of transportation to be made available along various shipping legs, and the kind of information system to be used. The choice by PepsiCo Inc. to acquire two of its biggest bottlers in 2009 was made strategically or in terms of supply chain design.

   During this stage, a company must make sure that the supply chain configuration advances its strategic goals and increases supply chain surplus [5], [6]. While the existing model has served the system very well, the fully integrated beverage business will enable us to bring innovative products and packages to market faster, streamline our manufacturing and distribution systems, and react more quickly to market changes, the PepsiCo CEO stated in a news release on August 4. Changes in the industry. Decisions about supply chain design are often taken for the long term, and they are expensive to change suddenly. As a result, organizations must consider the volatility of expected market conditions over the following several years while making these decisions.
2. **Planning the Supply Chain:** The time period taken into account for decisions made at this stage is between a quarter and a year. As a result, the supply chain's strategic phase configuration is set in stone. This setup creates restrictions that planning must adhere to. Planning's objective is to increase the supply chain surplus that can be produced throughout the planning horizon while taking into account the limitations set during the

strategy or design phase. Companies begin the planning phase with a forecast of demand and other elements, such as expenses and pricing in various markets, for the following year a comparable time period. Making decisions about which markets will be serviced from which locations, outsourcing manufacturing, the inventory management procedures to be followed, and the timing and scope of marketing and price promotions are all examples of planning.

Planning decisions include, for instance, the choices made by the steel company ArcelorMittal on the markets served by a production plant and the intended production levels at each location. A supply chain's operating parameters are established by planning for a given time frame. Companies must factor unpredictability in demand, exchange rates, and competition over this time horizon into their strategy during this phase. Companies in the planning phase attempt to leverage any flexibility built into the supply chain in the design phase and exploit it to optimism performance given a shorter time period and better projections than in the design phase. Companies establish a set of operating policies to guide their short-term operations as a result of the planning process [7].

3. **Supply Chain Management:** Here, the time frame is either weekly or daily. Companies make decisions about specific customer orders during this time. The supply chain configuration is viewed as fixed at the operational level, and planning guidelines have already been established. The optimum way to manage incoming customer orders is the objective of supply chain operations. Businesses assign inventory or production to specific orders during this phase, define a date by which an order must be fulfilled, create pick lists at a warehouse, designate an order to a specific shipping mode and shipment, schedule truck deliveries, and place replenishment orders.
4. **Demand Information:** It is less ambiguous since operational choices are made in the near term within minutes, hours, or day. The objective of the operation phase is to take advantage of the decrease of uncertainty and optimism performance within the restrictions imposed by the configuration and planning policies.
5. **On Total Profitability and Success:** It is a supply chain's design, planning, and management have a significant impact. It is reasonable to say that the efficient supply chain design, planning, and operation responsible for the success of companies like Wal-Mart and Seven-Eleven Japan. We create ideas and provide approaches that can be applied at each of the three decision phases mentioned earlier in later chapters. The planning and design stages of the supply chain make up the majority of our conversation.
   Nation among those who control interdependent processes.

Supply Chain Examples

This section examines a number of supplies chains and poses issues that need to be resolved throughout the stages of conception, preparation, and implementation. We address ideas and provide approaches that can be utilised to provide answers to these concerns in later chapters. Apple and Gateway's divergent forays into retail Gateway was established in 1985 as a PC direct sales manufacturer with no presence in stores. One of the first PC manufacturers to launch online sales was Gateway in 1996. In the late 1990s, Gateway started an aggressive strategy of opening Gateway retail outlets across the United States after selling its PCs for many years without a retail infrastructure. Its stores didn't stock finished goods and were mostly concerned with assisting consumers in choosing the best configuration to buy. From one of the assembly sites, all PCs were transported to the customer after being built to order. Investors at first praised Gateway for this tactic, driving the stock price to over $80 per share in late 1999. This success, though, did not persist.

By November 2002, shares of Gateway had fallen to about $4, and the company was losing a sizable sum of money. Gateway eliminated all of its retail locations and decreased the

number of configurations available to consumers by April 2004. Acer of Taiwan acquired Gateway in August 2007 for a cost of $710 million. By 2010, more than 20 different retail locations, including Best Buy and Costco, sold Gateway PCs. This was a significant adjustment for the business to go through, as you could expect. Apple, on the other hand, has had great success ever since it launched its first retail location in 2001 [8]. In 2010, Apple had more than 300 locations throughout the world, and 15% of its overall net revenues came from retail. Apple, as opposed to Gateway, has always kept product inventories on hand. Apple's retail selection isn't all that diverse given the way its products are made. Each of its locations has a comparatively high level of sales; in 2009, the Regent Street location in London achieved revenues of £2,000 per square foot. Apple reported retail sales of approximately $10 billion in its 2010 annual report, an increase of 47% from the year before. The decisions made in the supply chain that affect how Apple and Gateway perform differently are highlighted by the questions below:

1. Why did Gateway decide not to stock any finished goods in its retail locations?
2. Why did Apple decide to stock its stores with merchandise?
3. Should a company with a stake in retail establishments stock any finished goods? What qualities need products have in order to be carried in completed goods inventory? What qualities distinguish the best made-to-order products?
4. How does product variety impact the quantity of stock a retail establishment must maintain?
5. Is it always more affordable for a direct selling supply chain without retail locations than one with them?
6. What aspects of Apple retail's success and the collapse of Gateway country stores can be attributed?

Zara

The largest clothing manufacturer and retailer in Spain, Indicted, is the owner of the Zara network of clothing stores. Indicted recorded revenues of over 11 billion euros in 2009 from more than 4,700 retail locations in roughly 76 different countries. Zara has had significant growth in a market where client demand is erratic thanks to a strategy of being extremely sensitive to shifting trends while maintaining competitive pricing. Zara has achieved cycle times of four to six weeks, compared to the industry average of more than six months for design to sales cycle times. Zara is able to debut new designs every week and modify 75% of its inventory display every three to four weeks because to this pace. Thus, compared to the competitors, Zara's products on display considerably more closely reflect client tastes. As a result, fewer things are marked down at Zara's stores than in those of its rivals, and the majority of its products are sold at full price.

Zara produces their clothing by combining rapid, flexible sources in Europe mostly Portugal and Spain with affordable sources in Asia. In contrast, the majority of apparel producers have relocated the majority of their manufacturing to Asia. Indicted owns about 40% of the manufacturing capacity, with the remaining 60% being outsourced. While products with more predictable demand are sourced from its Asian sites, products with very uncertain demand are sourced from Europe. After the start of the sales season, more than 40% of its completed goods purchases and the majority of its in-house production take place. This contrasts with a normal retailer's production level after the start of a sales season being less than 20%. Zara can lower inventory and prediction error thanks to its reactivity and the deferral of choices until after trends are understood. In order to guarantee that the most recent sales statistics are available to guide replenishment and manufacturing decisions, Zara has also made significant investments in information technology.

In 2009, Indicted shipped goods from eight Spanish distribution centers to retailers all over the world. The group asserted that the average delivery time from the time an order was received at the distribution center (DC) to the time it was delivered to the stores was 24 hours for European stores and up to 48 hours for stores in America or Asia. Several times every week, shipments were made from the DCs to the stores. This made it possible to precisely match client demand with store inventory. The following inquiries bring up difficulties with the supply chain that are crucial to Zara's success and strategy:

1. What competitive advantage does Zara obtain from having a highly responsive supply chain?
2. Why did Indicted decide to have both internal and external manufacturing?
3. Why, given how much cheaper manufacturing in Asia is, has Indicted kept its capacity in Europe?
4. Why does Zara buy items with erratic demand from regional producers and items with steady demand from Asian producers?
5. When compared to a less frequent timetable, what benefit does Zara receive by refilling its stores numerous times a week? How is the distribution system's architecture impacted by the frequency of replenishment?
6. Do you believe Zara's rapid replenishment system is more appropriate for retail or online sales?

MRO Suppliers W.W. Grainger and McMaster-Carr

Products for maintenance, repair, and operations (MRO) are sold by W.W. Grainger and McMaster-Carr. Orders can be placed online and through catalogues for both businesses. Additionally, W.W. Grainger has several hundred outlets across the country. Customers can place orders in-person, over the phone, or online. Orders placed with W.W. Grainger can either be delivered to the consumer or picked up in person at one of its stores. In contrast, McMaster-Carr delivers practically all of its orders although a small number of clients in close proximity to its DCs do pick up their own goods. Nine DCs at W.W. Grainger fill orders from customers and replenish stores.

All orders are filled from one of McMaster's five DCs. Both McMaster and W.W. Grainger do not produce any goods. They primarily play the part of a retailer or distributor. Their capacity to control their supply chain is a key factor in their success. Both businesses provide their clients with several millions of products. McMaster holds roughly 500,000 stock-keeping units (SKU), compared to about 200,000 at Grainger. In addition, Grainger offers a wide range of additional goods that it does not keep in stock directly from its vendors [9]. The following tactical problems affect both businesses:

1. How many DCs ought to be constructed, and where ought they to be situated?
2. How ought the DCs to handle product stocking? Should all DCs stock every item?
3. Which items ought to be kept in stock, and which ought to be given to the supplier to be sent directly in response to a client order?
4. What goods ought to a W.W. Grainger store stock?
5. How should DCs be assigned markets for order fulfilment? What should be done if a DC is unable to fill an order entirely? Should there be specific locations for backups? How are they to be chosen?
6. How should the various stocking locations handle inventory replenishment?
7. How should Web orders be handled in light of current operations? Is it preferable to create a new distribution channel for the Web business or to merge it with the current one?
8. Which forms of transportation ought to be employed for order fulfilment and stock restocking [10].

CONCLUSION

The profitability and competitiveness of firms in today's changing economy depend greatly on supply chain management. Organizations may optimism operations, cut costs, improve customer service, and gain a competitive advantage with the help of smart supply chain management. Businesses can achieve cost efficiency and boost profitability by streamlining procedures, cutting inventory carrying costs, and increasing order fulfilment rates. Additionally, supply chain management promotes stakeholder cooperation and communication, enabling effective coordination and responsiveness. Additionally, it helps firms reduce risks, develop resilience, and adjust to shifting consumer needs. Adopting sustainable and socially conscious supply chain practices not only improves brand reputation but also satisfies client demands.

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CHAPTER 5

SUPPLY CHAIN PERFORMANCE: ACHIEVING STRATEGIC FIT AND SCOPE

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ABSTRACT:

For organizations looking to acquire a competitive edge in today's complicated and changing business climate, achieving optimal supply chain performance is essential. This essay examines supply chain management's notions of strategic fit and scope, emphasizing their importance in achieving exceptional performance. In order to ensure that supply chain activities complement the goals and objectives of the organization, the terms strategic fit and business strategy are used interchangeably. Contrarily, scope includes the breadth and depth of the supply chain network, as well as the quantity of suppliers, routes of distribution, and geographic coverage.

KEYWORDS:

Competitive Strategy, Chain, Demand, Mcmaster Carr, Uncertainty.

INTRODUCTION

In relation to its rivals, a company's competitive strategy identifies the range of consumer needs it aims to meet with its goods and services. For instance, Wal-Mart strives to offer a wide selection of goods with acceptable quality at competitive costs. The majority of the items sold at Wal-Mart are standard items that may be found elsewhere, including everything from clothing to household appliances. Wal-Mart offers affordable prices and a wide selection of goods. Products for MRO maintenance, repair, and operations are sold by McMaster-Carr. Through a catalogue and a website, it provides more than 500,000 products. Convenience, accessibility, and reactivity are key components of its competitive approach. Because of its emphasis on responsiveness, McMaster does not compete on the basis of low cost. Clearly, Wal-Mart's competitive approach differs from McMaster's. We can compare Zale's, which sells diamond jeweler through retail stores, to Blue Nile, which uses an internet retailing approach for diamonds.

Blue Nile has emphasized the range of diamonds offered on its website as well as the fact that its margins are substantially smaller than those of its competitors who operate brick and mortar stores. However, customers must wait before receiving their jeweler and are unable to touch or otherwise inspect it before making a purchase although Blue Nile does provide a 30-day return policy. In contrast, a customer can enter Zale's, receive assistance from a salesman, and depart right away with a diamond ring. A Zale's store does not offer a wide selection, though. A typical Zale's store has fewer than a thousand stones, compared to Blue Nile's website's more than 70,000 selection [1]. The competitive strategy is established for each situation depending on how the customer values product pricing, delivery time, variety, and quality. Customers of McMaster-Carr priorities product variety and reaction time over price. Contrarily, a Wal-Mart buyer prioritizes price more. When making an online purchase from Blue Nile, a consumer emphasizes both product variety and price. Customers at Zale's are more interested in quick responses and assistance with product selection. As a result, a company will base its competitive strategy on the priorities of its clients.

A competitive strategy focuses on one or more client categories and tries to meet the demands of these customers with goods and services. We start with the value chain for a typical organization, to see how competitive and supply chain strategies relate to one another. New product development, which establishes the product's requirements, is where the value chain starts. By highlighting the client priorities that the products and services will address, marketing and sales create demand. Customer feedback is also brought back to new product development through marketing. Operations convert inputs to outputs using the updated product standards to produce the product. Distribution either brings the client to the product or transports the goods to the customer. Customer needs are addressed during or after the transaction through service. These are essential procedures or duties that must be fulfilled for a sale to be successful [2].

The value chain's operation is supported and facilitated by finance, accounting, information technology, and human resources. All of these roles have a part in carrying out a company's competitive strategy, and each must create its own strategy in order to do so. Here, a process' or function's strategy refers to what it will specifically strive to accomplish. A company's planned portfolio of new items is laid out in a product development strategy. It also determines whether the development effort will be carried out in-house or externally. A marketing and sales plan outlines the market segmentation and product positioning, pricing, and promotion. The type of raw material procurement, material transportation to and from the business, product or service manufacturing, product distribution to the customer, any follow-up services, and a description of whether these processes will be carried out internally or externally are all determined by the supply chain strategy.

The operations, distribution, and service functions whether internal or external should excel at certain things, according to the supply chain strategy. We define supply chain strategy in more detail because that is what this article is about. Supply chain strategy specifies the general layout of the supply chain as well as what are commonly referred to as supplier strategy, operations strategy, and logistics strategy. For instance, Dell's initial decision to sell direct, Cisco's choice to employ contract manufacturers, and its 2007 decision to begin selling PCs through resellers all define the general structure of their supply chains and are components of their supply chain strategy. Design choices for inventory, transportation, operational facilities, and information flows are also part of supply chain strategy. For instance, as part of their supply chain strategy, Amazon built warehouses to hold some products and continued to purchase other products from wholesalers. Similar to this, Toyota's supply chain strategy is shown in its choice to establish manufacturing plants in all of its key markets.

All functional strategies must complement one another and the competitive strategy for a company to be successful. The marketing at Seven-Eleven has placed an emphasis on convenience in the form of simple access to stores and availability of a wide range of goods and services. For instance, Seven-Eleven Japan's success can be connected to the great fit among its functional strategies.

Seven-Eleven is continually developing new products and services, such as bill payment services, to attract customers and take advantage of both the top-notch information infrastructure and the regular customer traffic to the store. Seven-Eleven's operations and distribution have prioritized having a high store density, being extremely responsive, and having a top-notch information infrastructure. The outcome is a positive feedback loop where supply chain infrastructure is utilised to provide new goods and services that boost demand, and the higher demand in turn makes it simpler for operations to improve store density, replenishment responsiveness, and information infrastructure. We expand on this idea of fit and try to provide an answer in the next section. What should a company's supply chain aim to perform particularly well given its competitive strategy?

Implementing a Strategic Fit

A corporation must have goals that are in line with its supply chain and competitive strategy in order to be strategically fit. It refers to harmony between the supply chain capabilities that the supply chain strategy seeks to develop and the client priorities that the competitive strategy aspires to please. A corporation needs to accomplish the following in order to attain strategic fit:

1. To create a cohesive overall strategy, the competitive strategy and all functional strategies must work together. In order for a company to achieve its competitive strategy objective, each functional strategy must complement other functional strategies.
2. To successfully implement these strategies, the various functions of a corporation must properly structure their resources and processes.
3. In order to support the supply chain strategy, the overall supply chain design and the functions of each stage must be in sync.

DISCUSSION

A business may fail for a number of reasons, including a lack of strategic fit or the inability of its whole supply chain design, processes, and resources to support the intended strategic fit. Think about a scenario where marketing promotes a business's capacity to provide a wide range of products promptly, but distribution focuses on the most affordable means of delivery. In this circumstance, it is possible that distribution will postpone orders in order to consolidate them or use inexpensive but slow modes of delivery in order to achieve better transportation economics. This move runs counter to marketing's declared objective of offering variety quickly. Similar to the last example, imagine that a merchant has made the decision to offer a high level of variety while maintaining low amounts of inventory, but has chosen suppliers and carriers based on their low prices rather than their responsiveness.

Due to the retailer's inadequate product availability, angry customers are probably what will happen in this situation. Let's look at the development of Dell and its supply chain to further explain the concept of strategic fit. Dell's competitive strategy from 1993 to 2006 was to offer a wide range of customizable products at affordable prices [3]. Dell's supply chain was created with a strong emphasis on customization, making it particularly responsive. Dell's assembly facilities were created to be adaptable and manage the large range of configurations that customer’s desire. This environment would not have suited a plant that prioritized low cost and efficiency by producing vast quantities of the same configuration. Other Dell departments were included in the concept of strategic fit. Dell computers were made with readily available components and quick assembly in mind. The purpose of the supply chain, which was to assemble customized PCs in response to customer requests, was clearly well-aligned with this design strategy. Dell put a lot of effort into bringing this alignment to its vendors.

Because Dell manufactured customized goods with little inventory, it was essential that suppliers and shippers respond quickly. For instance, carriers' ability to combine a PC from Dell with a Sony monitor allowed Dell to discontinue stocking Sony monitors. Dell, however, changed its supply chain and competitive approach beginning in 2007. The business expanded into selling PCs through retail establishments like Wal-Mart while continuing to offer customization. However, the selection at retail is considerably dissimilar from the direct sales channel's emphasis on customization. Dell sells a constrained selection of desktops and laptops via Wal-Mart. Additionally, it is critical that monitors and other peripherals be readily accessible in stock because Wal-Mart customers are unwilling to wait for the monitor to arrive after they purchase a PC. It is obvious that when customers no longer want personalization but instead choose low pricing, the flexible and responsive supply chain that

properly fits with customer needs for customization does not necessarily align well. In order to retain strategic fit, how should Dell modify its various functional strategies in light of the altered competition strategy? One of Dell's initial answers has been to expand its reliance on contract manufacturers headquartered in low-cost nations for assembly and stop building everything to order.

How Can a Strategic Fit Be Attained?

What steps must a business take to achieve the crucial strategic alignment between its supply chain and its rivalry? One or more client categories that a company seeks to serve will be specified, either expressly or implicitly, in a competitive strategy. A corporation must make sure that its supply chain capabilities support its capacity to serve the needs of the targeted client groups in order to achieve strategic fit. To achieve this strategic fit, there are three fundamental phases that we briefly summaries here before going into greater detail:

1. Recognizing the Customer and Supply Chain Uncertainty. A corporation must first recognize the customer needs for each targeted market segment and the supply chain uncertainty these needs entail. These requirements aid the business in defining the targeted cost and service standards. The supply chain uncertainty aids the business in determining the degree of demand uncertainty, interruption, and delay for which the supply chain must be ready.
2. Recognizing the Capabilities of the Supply Chain. Each of the numerous types of supply chains is created to excel at specific jobs. A corporation has to know what its supply chain is optimized for.
3. Achieving Strategic Fit. The Company will either need to restructure the supply chain to support the competitive strategy or change its competitive strategy if there is a mismatch between what the supply chain does particularly well and the intended consumer needs.

Understanding the customer and supply chain uncertainty is the first step. A business must determine the needs of the consumer segment it is serving in order to comprehend the customer. Let's contrast Sam's Club, a bargain retailer that is a division of Walmart, with Seven-Eleven Japan. Customers who visit Seven-Eleven to buy detergent do so for the convenience of a local store rather than necessarily in search of the best deal. In contrast, a Sam's Club consumer values low prices highly [4]. If the price is cheap, this buyer can be content to accept less variety and even buy enormous package quantities. Even if people buy detergent at both locations, demand changes depending on a few factors. Customers of Seven-Eleven are on the go and demand convenience. Sam's Club is an example of a company that wants a bargain and is prepared to put in the work to obtain it. Customer demand across various market groups typically differs along the following attributes:

1. **The Quantity of the Product Needed in Each Lot:** A modest quantity of materials may be ordered in an emergency to fix a production line. An order for supplies to build a new production line is probably going to be substantial.
2. **The Response Time That Customers Are Willing to Tolerate:** While a construction order's acceptable response time is likely to be lengthy, an emergency order's tolerable response time is likely to be quick.
3. **The Variety of Products Required:** For an emergency repair order, a customer can place a high value on all the parts being available from a single source. The construction order might be an exception to this.
4. **The Required Service Level:** A customer placing an urgent order anticipates a high degree of product availability. If some components of the order are not immediately available, this consumer might shop somewhere else. In the event of the building order, where a lengthy lead time is probable, this is unlikely to occur.

5. **The Product's Price:** Compared to customers placing building orders, emergency borderers are likely to be far less price sensitive.

Customers of a high-end department store anticipate a high level of innovation and fresh ideas in the store's clothing. It's possible that Walmart customers are less receptive to new product innovation. Customers in one segment likely to have demands that are similar to one another, but customers in another segment may have needs that are extremely distinct from one another. Even though we've listed a variety of characteristics that influence client demand, our aim is to pinpoint a single critical factor that may be used to combine all of these characteristics. This one measurement then aids in defining what the supply chain should excel at. Demand Implied Uncertainty. Despite the fact that each customer need can be fundamentally translated into the metric of implied demand uncertainty demand uncertainty that is imposed on the supply chain as a result of the customer needs it seeks to satisfy it may initially appear that each of the customer need categories should be viewed differently.

We differentiate between explicit and implicit demand uncertainty. Uncertainty in demand reflects ambiguity in consumer demand for a given good. Contrarily, implied demand uncertainty is the uncertainty that results for just the fraction of the demand that the supply chain aims to meet based on the qualities the customer wants. For instance, a company that only fills emergency orders for a product will have greater implied demand uncertainty than a company that fills orders for the same product with a long lead time because the latter company will have more time to complete orders equally. The influence of service level is another example of why this distinction is necessary. A supply chain must be able to fulfil an increasing percentage of actual demand as it enhances its level of service, pushing it to be ready for sporadic spikes in demand. As a result, even while the underlying demand uncertainty for the product remains unchanged, improving the service level increases the inferred demand uncertainty. Implied demand uncertainty is influenced by both the product demand uncertainty and the numerous customer needs that the supply chain strives to meet. The impact of different customer needs on inferred demand uncertainty [5].

Understanding the supply chain's capabilities is step two. The second issue is: How does the company effectively meet demand in that uncertain environment after knowing the uncertainty it faces? Strategic fit is all about designing a supply chain strategy that, given the uncertainties a firm face, best satisfies the demand it has targeted. Now let's look at supply chain characteristics and categories them according to several traits that affect their responsiveness and effectiveness. We start by giving some definitions. A supply chain's capacity to respond to demand includes the following: Responding to a broad range of quantity demands, meeting short lead times, handling a wide range of items, creating highly inventive products, meeting high service standards, and managing supply uncertainty many of the qualities of supply and demand that produced significant implied uncertainty are shared by these skills. A supply chain is more responsive when it possesses more of these capabilities. However, responsiveness has a price.

For instance, expanding capacity is necessary to meet a greater variety of quantity demands, which raises expenses. The second definition results from this cost increase Efficiency of the supply chain is inversely proportional to the price of producing and delivering a product to the client. Cost increases reduce efficiency. There are additional costs that reduce efficiency for every tactical decision to improve responsiveness. The curve depicting the lowest cost for a specific level of responsiveness is the cost-responsiveness efficient frontier. The definition of lowest cost is based on currently available technology; not all businesses are able to operate on the efficient frontier, which captures the performance of the best supply chains in terms of cost responsiveness. The responsiveness and cost performance of a company that is not on the efficient frontier can both be enhanced by heading in that direction. A company on the efficient frontier, however, can only increase responsiveness by raising costs and losing

efficiency. Thus, such a company is forced to choose between efficiency and responsiveness. Of course, businesses operating on the efficient frontier are also constantly enhancing their procedures and updating technology in an effort to move the border itself.

An important strategic decision for any supply chain is the level of responsiveness it intends to offer given the trade-off between cost and responsiveness. From supply chains that are purely focused on being responsive to those that are focused on a goal of creating and supplying at the lowest cost, there are a variety of supply chains. Depicts the responsiveness spectrum and the positions of several supply chains on it. A supply chain's responsiveness increases with the number of capabilities that make up responsiveness. With breakfast items in the morning, lunch items in the afternoon, and dinner items at night, Seven-Eleven Japan restocks its stores. As a result, depending on the time of day, different products are offered. With store managers submitting replenishment orders fewer than 12 hours before they are filled, Seven-Eleven answers to requests swiftly. The supply chain at Seven-Eleven is particularly responsive as a result of this practice. W.W. Grainger is another illustration of a responsive supply chain.

In order to provide consumers with a wide range of MRO items within 24 hours, the company has constructed its supply chain to deal well with both demand and supply volatility. In contrast, an effective supply chain reduces costs by reducing part of its responsiveness. Sam's Club, for instance, offers a small selection of goods in huge package sizes [6]. The supply chain can operate at cheap costs, and efficiency is clearly its main priority. Reaching Strategic Fit in Step 3 The third and last stage is to confirm that the degree of supply chain responsiveness is commensurate with the implied uncertainty after mapping the level of implied uncertainty and understanding the supply chain's position on the responsiveness spectrum. High responsiveness is the target for a supply chain with high implied uncertainty, and efficiency is the target for a supply chain with low implied uncertainty.

For instance, McMaster-Carr's competitive strategy focuses on clients who value having a wide range of MRO supplies supplied to them within 24 hours. Given the wide range of products and the quick turnaround times that are preferred, McMaster-Carr customers' demand might be described as having a high indicated demand uncertainty. McMaster-Carr can create a supply chain that is either effective or responsive. In order to reduce the cost of picking and packaging, an effective supply chain may carry less inventory and maintain a constant load in the warehouse. If McMaster-Carr made these decisions, it would be challenging to meet the needs of customers who want a wide range of products delivered within 24 hours. McMaster-Carr maintains a significant quantity of inventory as well as a large picking and packaging capability to successfully serve its clients. Even if it results in greater costs, it is obvious that a responsive supply chain is more equipped to meet the needs of the consumers that McMaster-Carr is targeting. Think about a company that makes pasta, like Barilla. Pasta has a low indicated demand uncertainty because to its generally steady consumer demand.

Additionally, supply is quite dependable. Barilla may create a highly adaptable supply chain where pasta is created to order in tiny amounts in response to consumer demands and delivered quickly, like via FedEx. Obviously, this decision would drive up the price of the pasta to an unaffordable level, driving away buyers. Therefore, Barilla will be in a lot better position if it creates a more effective supply chain that focuses on cost savings. The discussion that has come before suggests that the best way to deal with growing implied uncertainty from suppliers and customers is to make the supply chain more responsive. The zone of strategic fit serves as a representation of this relationship. Companies should move their supply chain strategy and resultant responsiveness and competitive strategy and inferred implied unpredictability into the zone of strategic fit for a high level of performance.

Assigning roles that ensure the proper level of responsiveness to various supply chain stages is the next step in establishing strategic fit. The following examples highlight how different levels of responsiveness and efficiency can be assigned to each stage of the supply chain in order to achieve the optimal level of responsiveness required throughout. Swedish furniture company IKEA operates sizable locations in more than 20 nations. Customers who desire chic furnishings at an affordable price are IKEA's target market. The company uses a modular design to restrict the range of models it sells. The size of each store and the small selection of furniture due to modular design lessen the implied uncertainty that the supply chain must deal with. IKEA carries all styles in stock and serves customers using what is on hand. In order to eliminate all supply chain unpredictability, it leverages inventories. Large IKEA stores have inventory, which makes replenishment orders to its producer's steadier and more predictable. As a result, IKEA transfers little risk to its suppliers, most of whom are based in low-cost nations and priorities productivity. IKEA offers supply chain responsiveness, with its stores absorbing the majority of uncertainty and being responsive, and its suppliers absorbing little uncertainty and being effective.

Another strategy for timeliness, though, would involve the shop having less goods on hand. In this instance, the retailer makes only a small contribution to the supply chain's responsiveness, while the manufacturer receives the majority of the implied demand uncertainty. The manufacturer now needs to be adaptable and quick to respond for the supply chain to be responsive [6]. The Tennessee-based furniture company England, Inc. is a prime example of this strategy. The company produces thousands of couches and chairs on demand each week, shipping them to furniture stores all over the nation in three weeks. Customers can choose from a wide range of styles at the merchants run by England Inc., and they guarantee a fairly quick turnaround. The supply chain is subjected to a significant degree of implied unpredictability as a result. However, because they don't carry a lot of inventory, the merchants transfer the majority of the implicit risk to England, Inc. Thus, the merchants can operate efficiently because England, Inc., with its adaptable production process, absorbs the majority of the supply chain's indicated unpredictability.

It is up to England, Inc. to decide how much risk it transfers on to its suppliers. The corporation enables its suppliers to concentrate on efficiency by keeping larger raw material stockpiles. Its suppliers will need to respond more quickly if it reduces its raw material stocks [7], [8]. The dialogue that just took place shows how the supply chain may become more responsive by changing the roles that each of its stages plays. By improving one stage's responsiveness, other stages can concentrate on improving their efficiency.

The effectiveness and adaptability offered at each level determine the ideal role combinations. The idea of reaching a specific level of responsiveness by dividing up the roles and degrees of uncertainty among the various supply chain phases. The illustration depicts two supply networks that experience the same implied uncertainty but exhibit different distributions of uncertainty and responsiveness along the supply chain to attain the desired level of responsiveness.

The retailer in Supply Chain I is very responsive and absorbs the majority of the risk, which enables no, demands efficiency from the manufacturer and supplier. Contrarily, Supply Chain II features a highly responsive manufacturer who takes on the majority of the uncertainty, leaving the other phases to concentrate on efficiency. A company must also make sure that all of its functions maintain consistent strategies that support the competitive strategy in order to attain full strategic fit. The objectives of the competitive strategy must be supported by all functional strategies. The amount of responsiveness of the supply chain must also be taken into consideration by all sub strategies within it, including production, inventory management, and purchasing. Some of the key functional strategy distinctions between supply networks that are responsive and those that are efficient.

CONCLUSION

For businesses to improve performance and acquire a competitive edge, supply chain management must achieve strategic fit and optimism scope. Organizations may make sure that their supply chain activities complement their aims and objectives by coordinating their supply chain strategy with their entire business strategy. The scope's inclusion of the full breadth and depth of the supply chain network is essential for enabling effective risk management, efficient operations, higher customer satisfaction levels, and increased profitability. To respond to market shifts and satisfy customer expectations, supply chain tactics must be continuously evaluated and improved.

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CHAPTER 6

INTRODUCTION TO SUPPLY CHAIN DRIVERS AND METRICS

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ABSTRACT:

Supply chain drivers and metrics are crucial parts of efficient supply chain management because they let businesses assess and improve the performance of their supply chains. This essay examines the idea of supply chain drivers as well as the metrics employed to assess and keep track of supply chain activities. The four main components of supply chain drivers are facilities, inventory, transportation, and information. These factors affect the supply chain network's overall efficacy and efficiency. Contrarily, metrics offer measurable measurements of numerous supply chain components, enabling organizations to evaluate performance, pinpoint areas in need of development, and make wise decisions.

KEYWORDS:

Competitive Strategy, Cross Functional Drivers, Efficiency, Responsiveness, Supply.

INTRODUCTION

A company's supply chain must strike the right balance between responsiveness and efficiency to meet the demands of the company's competitive strategy in order to achieve the strategic fit outlined. We must look at the logistical and cross-functional drivers of supply chain performance, including facilities, inventory, transportation, information, sourcing, and pricing, in order to comprehend how a business can increase supply chain performance in terms of responsiveness and efficiency. The performance of the supply chain in terms of responsiveness and efficiency is determined by how these drivers interact with one another. Therefore, whether and how strategic fit is accomplished across the supply chain depends on the structure of these drivers. We first explain each driver and talk about how it affects the efficiency of the supply chain. Facilities are the actual physical sites where a product is manufactured, assembled, or created in the supply chain network. Facilities can be divided into two categories: pro- and s-types. Decisions made about the function, location, and adaptability of facilities have a big impact on how well the supply chain works [1].

For instance, despite the fact that doing so lowers efficiency, an auto-parts distributor aiming for responsiveness can have numerous warehousing locations nearby consumers. Instead, a high-efficiency distributor would have fewer warehouses to boost efficiency, even though doing so would hinder responsiveness. All of the raw materials, work-in-progress, and finished commodities in a supply chain are included in inventory. The effectiveness and responsiveness of the supply chain can be significantly changed by altering inventory policies. For instance, a clothes retailer can increase its responsiveness by keeping a lot of products on hand and meeting demand from that inventory. However, a high inventory raises the retailer's costs, which reduces its efficiency. While inventory reduction increases merchant efficiency, it decreases responsiveness. Transportation involves transferring inventory along the supply chain from one location to another.

Numerous combinations of modes and routes, each with unique performance characteristics, can be used for transportation. The effectiveness and responsiveness of the supply chain are greatly influenced by the transportation options. For instance, a mail-order catalogue business can distribute products faster utilizing a service like FedEx, which increases supply chain

responsiveness but decreases efficiency due to the high expenses of employing FedEx. Alternately, the business can ship the product using slower but less expensive ground transportation, which would increase supply chain efficiency but reduce responsiveness. Information is data and analysis about locations, supplies, logistics, expenses, costs, and clients along the supply chain. Information may be the most important factor influencing performance in the supply chain because it has a direct impact on all other factors. Information gives management the chance to improve the responsiveness and effectiveness of supply chains.

A pharmaceutical company, for instance, can develop and stock medications in advance of customer demand if it has knowledge of customer demand trends. This makes the supply chain more responsive because clients will have access to the medications they require when they require it. Due to the pharmaceutical company's improved ability to estimate demand and create only what is necessary, this demand information can help increase the efficiency of the supply chain [2], [3]. By offering managers shipping alternatives, for example, that enable them to select the least expensive choice while still achieving the essential service standards, information may help increase the efficiency of this supply chain. Sourcing is the process of deciding who will handle a certain supply chain task, such as production, storage, transportation, or information management. These choices at the strategic level decide which tasks an organization conducts in-house and which tasks it outsources. A supply chain's responsiveness and efficiency are both impacted by sourcing choices.

The efficiency of Motorola's production increased once it outsourced a large portion of it to Chinese contract manufacturers, but the company's responsiveness suffered due to the enormous distances. Motorola began flying some of its cell phones in from China to make up for the decline in responsiveness, despite the fact that doing so raised the cost of shipping. Electronics contract producer Flextronics wants to give its clients quick and effective sourcing choices. It aims to maintain the effectiveness of its low-cost country facilities while improving the responsiveness of its American production facilities. With this set of resources, Flextronics aspires to become a reliable source for all clients. Pricing establishes the amount a company will bill for the products and services it makes available to the supply chain. Pricing has an impact on the buyer's actions, which has an impact on the operation of the supply chain. Clients who value efficiency are inclined to place early orders, whereas those who value responsiveness are likely to wait and place late orders, for instance, if a transport firm bases its rates on the lead time provided by the clients. If prices don't change depending on lead time, early orders are less likely.

We strive to distinguish supply chain management and logistics in our definition of these drivers. To increase supply chain surplus, supply chain management employs cross-functional and logistical drivers. Cross-functional drivers have recently played a bigger role in developing supply chain surplus. Supply chain management is increasingly concentrating on the three cross-functional drivers, even if logistics still plays a significant role. It is crucial to understand that these factors interact with one another rather than acting alone to affect the performance of the supply chain as a whole. A well-designed and operated supply chain takes into account this interaction and makes the necessary trade-offs to achieve the desired level of responsiveness. Think about the American furniture market, for instance. Many low-cost merchants sell furniture that was imported from Asia at low prices. This supply chain's main objective is to provide goods that are affordable and of acceptable quality. Retailers like Wal-Mart stock inventory of finished goods, and variety is often low. The limited selection and consistent replenishment orders enable Asian furniture producers to concentrate on efficiency. Low-cost means of shipping from Asia are utilised due to the inventory.

Here, relatively inexpensive inventory at the store makes the supply chain more effective by reducing the cost of production and delivery. Some American furniture manufacturers, on the

other hand, have opted to emphasize variation. It would be incredibly expensive for a store to maintain inventory of all variations given the wide diversity and high costs. The supply chain in this instance has been set up so that the store carries a minimal amount of inventory. Customers choose from a variety of possibilities after viewing one variation of the furniture before placing their orders with the merchant [4]. By leveraging information technology to efficiently transmit order information, building extremely flexible manufacturing facilities to be able to create in tiny amounts, and using responsive transportation to bring the furniture to the consumer, the supply chain is made more responsive. To reduce inventory costs in this situation, responsive transportation, information, and facilities are utilised. The key to ensuring strategic fit throughout the supply chain, as will be demonstrated in the subsequent chapter, is to arrange the supply chain drivers effectively to offer the needed amount of responsiveness. We organize the six drivers into a framework that helps to define each driver's function in enhancing supply chain performance before delving into each of the six drivers in more detail.

DISCUSSION

Remember from that a supply chain strategy aims to balance responsiveness and efficiency such that it complements the competitive strategy. A corporation must structure the ideal mixture of the three logistical and three cross-functional drivers outlined earlier in order to achieve this goal. Supply chain managers must choose between efficiency and responsiveness for each of the individual drivers based on their interactions with the other drivers. The responsiveness and profitability of the entire supply chain are therefore determined by the combined influence of these drivers. Presents a framework visually for supply chain decision-making. The majority of businesses first determine their competitive strategy before deciding on their supply chain strategy. The efficiency and responsiveness of the supply chain are determined by the supply chain strategy. In order to achieve the performance level that the supply chain strategy requires and increase supply chain profits, the supply chain must then make use of the three logistical and three cross-functional drivers. A review of the six drivers may often reveal the need to alter the supply chain and possibly even the competitive strategy, even though this framework is typically seen from the top down.

Think about this framework with Wal-Mart as an illustration. Being a trustworthy, affordable retailer for a variety of products intended for mass consumption is Wal-Mart's competitive strategy. According to this strategy, the ideal supply chain will priorities efficiency while yet maintaining a suitable level of responsiveness. To reach this level of supply chain performance, Wal-Mart effectively applies the three logistical and three cross-functional drivers. With the inventory driver, Wal-Mart keeps minimal amounts of inventory while yet maintaining an effective supply chain. For instance, Wal-Mart invented the cross-docking system, which involves delivering goods directly from manufacturers to stores rather than stocking them in warehouses. These shipments only stop in distribution centers (DCs) for a short time before being transferred to trucks that carry the goods to retailers. Because products are stocked solely at stores and not at both stores and warehouses, inventory is significantly reduced as a result. Wal-Mart favors efficiency above reactivity when it comes to inventories.

In order to maintain a high level of responsiveness, Wal-Mart manages its own fleet of vehicles. In Wal-Mart's case, the advantages in terms of decreased inventory and greater product availability outweigh this cost increase in transportation [5] Wal-Mart uses centrally situated DCs within its network of stores to reduce the number of facilities and boost productivity at each DC in the case of facilities. Wal-Mart only constructs retail outlets in areas where there is sufficient demand to support many stores with a DC, maximizing the effectiveness of its transportation resources. Wal-Mart has made a substantial investment in information technology compared to its rivals in order to use information in the supply chain.

Wal-Mart is a pioneer in its application of the information driver to raise responsiveness and lower inventory investment as a result. Wal-Mart communicates information about demand to suppliers along the supply chain so they can produce only what is needed.

The supply chain has become more responsive and efficient as a result of the significant investments made to enable the sharing of demand information. In terms of the sourcing driver, Wal-Mart finds reliable suppliers for each item it sells. They receive enormous orders from Wal-Mart, which enables them to take advantage of economies of scale and be effective. Wal-Mart uses everyday low pricing (EDLP) for their products as the last pricing driver. By doing this, it is made sure that consumer demand does not fluctuate in response to price changes. The goal of the entire supply chain is to effectively meet this demand. To achieve the ideal balance between responsiveness and efficiency and to align its competitive strategy and supply chain strategy, Wal-Mart leverages all the supply chain drivers. The six parts that follow go into great detail about each of the three logistical and three cross-functional drivers and how they fit into the supply chain. In this section, we go over the significance of facilities to the supply chain as well as the crucial decisions supply chain managers must make about facilities.

A Part of the Supply Chain

Facilities are where the supply chain is located if we consider inventory to be the and transportation to be the how of the supply chain. They are the places where the inventory is carried to or from. In a facility, inventory is either manufactured into a different state or stored warehousing.

Competitive Strategy Role

Facilities have a significant role in the responsiveness and efficiency of the supply chain. For instance, when a product is produced or stored in a single site, businesses can benefit from economies of scale and increased productivity. However, because many of a company's clients may be situated distant from the manufacturing location, the cost reduction comes at the sacrifice of responsiveness. The inverse is also accurate. Facilities that are situated close to customers require more facilities, which lowers efficiency. However, this facility option supports the company's competitive strategy goals if the client requires and is prepared to pay for the responsiveness that having multiple sites brings.

Inspiring Factors for Supply Chain Performance

The supply chain of a corporation must strike the right balance between responsiveness and efficiency in order to achieve the strategic fit outlined. We must look at the logistical and cross-functional drivers of supply chain performance, including facilities, inventory, transportation, information, sourcing, and pricing, in order to comprehend how a business can increase supply chain performance in terms of responsiveness and efficiency. The performance of the supply chain in terms of responsiveness and efficiency is influenced by how these forces interact. The objective is to structure the drivers to maximize responsiveness while minimizing costs, enhancing supply chain surplus and the firm's financial success. We first explain each driver and talk about how it affects the efficiency of the supply chain.

In the supply chain network, facilities are the real physical places where goods are stored, put together, or manufactured. Production sites and storage sites are the two main categories of facilities. The performance of the supply chain is significantly impacted by decisions made on the function, location, capacity, and adaptability of facilities. For instance, in order to strengthen its responsiveness, Amazon increased the number of warehousing facilities in 2009. In contrast, Blockbuster attempted to increase its efficiency in 2010 by closing several locations, despite the fact that this decreased response. If the company owns the facilities,

facility costs are reported under property, plant, and equipment; if the facilities are leased, they are reported under selling, general, and administration [6].

All of the raw materials, work-in-progress, and finished commodities in a supply chain are included in inventory. A company's inventory is listed under its assets. The effectiveness and responsiveness of the supply chain can be significantly affected by changing inventory policies. For instance, W.W. Grainger keeps itself responsive by maintaining high inventory levels and meeting customer demand with available goods, even when the high inventory levels hinder efficiency. As a result of the longevity of Grainger's products, this practice makes sense. In the fashion garment industry, where inventory depreciates rather quickly due to shifting trends and seasons, a large inventory strategy might be risky. Spanish clothing retailer Zara has worked hard to reduce lead times for new products and restocking rather than keeping large amounts of inventory. As a result, despite having minimal quantities of inventory, the company is incredibly responsive. Zara thus offers responsiveness at a reasonable price.

Transportation involves transferring inventory along the supply chain from one location to another. Numerous combinations of modes and routes, each with unique performance characteristics, can be used for transportation. The effectiveness and responsiveness of the supply chain are greatly influenced by the transportation options. For instance, a mail-order catalogue business can distribute products faster utilizing a service like FedEx, which increases supply chain responsiveness but decreases efficiency due to the high expenses of employing FedEx. However, McMaster-Carr and W.W. Grainger have designed their supply chain to offer next-day service via ground delivery to the majority of their clients. At a cheaper cost, they are offering a high level of responsiveness. Inbound transportation costs are normally included in the cost of goods sold, and outbound transportation costs for shipment to the consumer are typically included in selling, general, and administration expense.

Information is data and analysis about locations, supplies, logistics, expenses, costs, and clients along the supply chain. Information may be the most important factor influencing performance in the supply chain because it has a direct impact on all other factors. Information gives management the chance to improve the responsiveness and effectiveness of supply chains. In order to better match supply and demand while attaining production and distribution efficiencies, Seven-Eleven Japan, for instance, has exploited information. As a result, production and replenishment costs are reduced, and there is a high level of responsiveness to consumer demand. Costs associated with information technology are typically covered by operating expense usually under selling, general, and administrative expense or assets. For instance, in 2009, Amazon reported $551 million in fixed assets to be depreciated and $1.24 billion in operating expenses for technological expenses.

Sourcing is the process of deciding who will handle a certain supply chain task, such as production, storage, transportation, or information management. These choices at the strategic level decide which tasks an organization conducts in-house and which tasks it outsources. A supply chain's responsiveness and efficiency are both impacted by sourcing choices. The efficiency of Motorola's production increased once it outsourced a large portion of it to Chinese contract manufacturers, but the company's responsiveness suffered due to the enormous distances. Motorola began flying some of its cell phones in from China to make up for the decline in responsiveness, despite the fact that doing so raised the cost of shipping. Electronics contract producer Flextronics wants to give its clients quick and effective sourcing choices. It aims to keep its low-cost facilities productive while making its production facilities in high-cost regions very responsive [7], [8]. With this set of resources, Flextronics aspires to become a reliable source for all clients. The cost of products sold includes sourcing expenses, while accounts payable records any money owing to suppliers.

Pricing establishes the amount a company will bill for the products and services it makes available through the supply chain. Pricing has an impact on the buyer's actions, which has an impact on the operation of the supply chain. Clients who value efficiency are inclined to place early orders, whereas those who value responsiveness are likely to wait and place late orders, for instance, if a transport firm bases its rates on the lead time provided by the clients. Those who value responsiveness are given it through differential pricing, whereas those who do not value it as highly receive it at low cost. Any change in price has a direct influence on revenues but may also have an effect on costs depending on how it affects the other factors. Our definitions of these drivers make an effort to distinguish between supply chain management and logistics. To increase supply chain surplus, supply chain management employs cross-functional and logistical drivers.

Cross-functional drivers have grown more significant in recent years as the supply chain surplus has increased. Supply chain management is increasingly focusing on the three cross-functional drivers, even if logistics still plays a significant role. It's crucial to understand that these factors combine rather than acting individually to affect supply chain performance as a whole.

In order to achieve the needed level of responsiveness, good supply chain design and operation recognize this interplay and make the necessary trade-offs. Take the American furniture market as an illustration. Many low-cost merchants sell furniture that was imported from Asia at low prices. This supply chain's main objective is to provide goods that are affordable and of acceptable quality. Retailers like Wal-Mart stock inventory of finished goods, and variety is often low. The limited selection and consistent replenishment orders enable Asian furniture producers to concentrate on efficiency. Given the supply, inexpensive forms of transportation. are utilised for transportation coming from Asia. Here, relatively inexpensive inventory at the store makes the supply chain more effective by reducing the cost of production and delivery.

Some American furniture manufacturers, on the other hand, have opted to emphasize variation. Maintaining inventory of every variation at a merchant would be incredibly expensive because of the great diversity and high costs. In this instance, the store carries a minimal amount of inventory due to the supply chain's design. Customers choose from a variety of possibilities after viewing one variation of the furniture before placing their orders with the merchant. By utilizing information technology to efficiently communicate order information, designing adaptable production facilities to be able to create in small lots, and using responsive transportation to deliver the furniture to the consumer, the supply chain is made responsive. To reduce inventory costs in this situation, responsive transportation, information, and facilities are utilised.

The key to ensuring strategic fit and solid financial performance throughout the supply chain, as will be shown in the remaining sections of this chapter, is to arrange the supply chain drivers effectively to deliver the right level of responsiveness at the lowest cost. According to Doyen et al., the financial performance of garment shops is impacted by the supply chain to a degree of around 35%.

They claim that markdowns, which account for 10–30% of sales, and lost sales, which account for 5–10% of sales, are the main factors influencing retailers' financial performance. They add that handling shop items accounts for 3-5 percent, storage for 1-3 percent, transportation for 2-5 percent, and inventory for 2-5 percent of sales. It is obvious that supply chain success along the six drivers has a considerable impact on a firm's financial performance, albeit the exact percentage will vary for different supply chains. Before delving into each of the six drivers in greater detail, we organize them into a framework that makes their respective contributions to enhancing supply chain performance more clearly.

Framework for Structuring Drivers

A supply chain strategy aims to balance responsiveness and efficiency such that it complements the competitive strategy. A business must structure the three logistical and three cross-functional drivers in the appropriate order to achieve this goal. The responsiveness and profitability of the entire supply chain are therefore determined by the combined influence of these drivers. Presents a framework visually for supply chain decision-making. The majority of businesses first determine their competitive strategy before deciding on their supply chain strategy. The efficiency and responsiveness of the supply chain are determined by the supply chain strategy. The supply chain must then make use of the three logistical and three cross-functional drivers to operate at the level required by the supply chain strategy and increase revenues. Despite the fact that this framework is typically seen top-down, a study of the six drivers may often point to the need to alter the supply chain strategy and possibly even the competitive strategy.

Think about this framework with Wal-Mart as an illustration. Being a trustworthy, affordable retailer for a variety of products intended for mass consumption is Wal-Mart's competitive strategy. According to this approach, the ideal supply chain will priorities effectiveness while maintaining a sufficient level of responsiveness in terms of product availability. To reach this level of supply chain performance, Wal-Mart efficiently employs the three cross-functional and three logistical drivers. With the inventory driver, Wal-Mart keeps minimal amounts of inventory while yet maintaining an effective supply chain. Wal-Mart, for example, was a pioneer in the development of cross-docking, a system in which inventory is not stocked in a warehouse but rather shipped to stores from the manufacturer with a brief stop at a distribution center (DC), where product is transferred from inbound trucks from the supplier to outbound trucks to the retail store. Because products are stocked solely at stores and not at both stores and warehouses, inventory is significantly reduced as a result. Wal-Mart favors efficiency above reactivity when it comes to inventories. In order to maintain a high level of responsiveness, Wal-Mart manages its own fleet of vehicles.

Contribution to the Supply Chain

A mismatch between supply and demand is the cause of inventory in the supply chain. At a steel company, where it is cost-effective to produce in big quantities that are then held for upcoming sales, this mismatch is on purpose. At a retail location where inventory is kept in anticipation of future demand, the mismatch is likewise on purpose. By having the product ready and accessible when the client needs it, inventory increases the amount of demand that can be supplied, which is a crucial function it plays in the supply chain. Utilizing potential economies of scale in production and distribution is another important function of inventory in lowering costs. Assets held, expenses incurred, and supply chain responsiveness are all impacted by inventory. High volumes of inventory in a supply chain for clothes increase responsiveness but also make it more susceptible to the need for markdowns, which reduce profit margins. If clients are unable to find the products, they are ready to buy, low inventory levels could cost businesses sales.

Inventory has a substantial impact on how quickly materials move through a supply chain. The amount of time that passes between the points at which a material enters the supply chain to the point at which it leaves it is known as the material flow time. The throughput of a supply chain is the speed at which sales take place. Little's law can be used to determine how inventory, flow time, and throughput are related if inventory is denoted by I, flow time by T, and throughput by D For instance, little’s rule tells us that the inventory is 60 10 600 units if the flow time of an auto assembly process is 10 hours and the throughput is 60 units per hour. Our flow time would be lowered to 5 hours (300/60) if we could keep throughput constant while reducing inventory to 300 units. We observe that the units for inventory and throughput

must be constant in this relationship. Here, it stands to reason that inventory and flow time are equivalent in a supply chain since throughput is frequently influenced by consumer demand [9]. Reduced flow time can be a substantial advantage in a supply chain; thus, managers should take measures that reduce the quantity of inventory required without raising costs or impairing responsiveness.

Contribution to the Competitive Strategy

A supply chain can vary in responsiveness from very low cost to very low cost depending on the kind, location, and quantity of product. Although it comes at a significant expense, having a lot of completed goods inventory close to the customers allows a supply chain to be responsive. A supply chain can reduce costs by centralizing raw material inventory, but at the sacrifice of responsiveness. Finding the proper form, location, and quantity of inventory that offers the optimal level of responsiveness at the lowest cost is the aim of good supply chain design.

CONCLUSION

In order to assess and improve the performance of the supply chain, it is essential to use supply chain drivers and metrics. The framework for effective supply chain operations is provided by the four primary drivers of facilities, inventory, transportation, and information. Organizations may improve the performance of their whole supply chain and meet strategic goals by successfully managing these drivers. Metrics are quantitative measurements that can be used to evaluate a variety of supply chain factors, including price, quality, delivery, flexibility, and sustainability. Organizations must choose meaningful indicators that offer practical insights and link measures with their strategic aims.

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CHAPTER 7

DESIGNING DISTRIBUTION NETWORKS AND APPLICATIONS TO ONLINE SALES

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ABSTRACT:

Supply chain management's crucial component of designing distribution networks is made especially clear in the context of online sales. This essay examines the value of creating efficient distribution networks and how they are used in online commerce. In order to provide effective and timely product delivery to clients, distribution network design entails figuring out the best configuration of facilities, transportation routes, and inventory location. Due to the specific difficulties presented by e-commerce, such as shorter order-to-delivery times, rising customer expectations, and the need to allow returns and exchanges, the design of distribution networks becomes even more important in the context of online sales.

KEYWORDS:

Chain Management, Distribution Network, Management Systems, Online Sales, Supply Chain Network.

INTRODUCTION

The management and design of supply chains are heavily influenced by supply chain specialists. They assist in deciding whether a good or service is delivered internally by the company insourcing or externally by another company outsourcing while designing supply chains. Supply chain managers coordinate manufacturing across numerous providers to ensure that production and transportation of commodities occur with the least amount of quality control or inventory issues. A successful product build at a low cost is one of the objectives of a well-maintained supply chain. Such a supply chain might be viewed as a firm's competitive advantage. Beyond the construction and upkeep of the actual supply chain, supply chain experts also take part in corporate activities including sales forecasting, quality control, strategy creation, customer service, and systems analysis. An outdated supply chain design may become obsolete as a result of changes in a product's production over time. Supply chain specialists must be aware of production and economic developments that affect supply chains and develop backup supply networks if necessary.

The main concerns of supply chain managers were identified in a research project by Michigan State University's Broad College of Business, with input from 50 participating organizations, as being capacity/resource availability, talent recruitment, complexity, threats/challenges supply chain risks, compliance, and cost/purchasing issues. It was noted that keeping up with the regular changes in regulation was a significant challenge. Supply Chain Digest and Gartner have both cited supply chain complexity as a recurring difficulty. To evaluate a supply chain's productivity and, ideally, to increase it, supply chain consultants may offer their expert expertise [1]. The goal of supply chain consulting is to assist management by adding value to the entire process through the various sectors, from the ordering of raw materials to the final product. This is done by sharing knowledge on how to exploit existing assets through improved coordination. In order to address the issue, businesses can either hire external consultants or form internal consulting teams. Businesses pick between the two options while taking into account a variety of criteria. Employing

outside consultants is a standard practice for businesses. The study of the complete supply chain, together with any necessary countermeasures or correctives, is typically part of the consulting process as a whole.

Design Distributor Networks

The network system utilised in distributed computing, or distributed networking, is one in which computer programming, software, and its data are dispersed across multiple computers but nevertheless rely on one another and exchange complicated messages through their nodes computers. Sharing resources is what distributed networks do, usually to achieve a common or related aim. This often happens across a computer network, although internet-based computing is becoming more and more common. Processes, threads, agents, and distributed objects are typically seen in distributed networking systems. Scattered networks often involve concurrent programmer execution; simply having scattered physical components is insufficient.

Client Server

A principal computing center, known as the server, responds directly to the client by providing the requested data, occasionally through an agent, in client computing, a form of distributed computing. In web-based computing, client distributed networking is also common. The client/server model assumes that a client computer can offer some features to a user while requesting others from servers that offer services to clients. The Hypertext Transfer Protocol HTTP on the Web is essentially client. The control of an agent or component in a distributed network may also be loosely defined, and the components may have pre-configured or dynamic settings. Decentralized Decentralization is the antithesis of the client/server concept in that each machine on the network can be used for the current computing task. It is believed that networks are more efficient in this way since they often only use idle computers. A decentralized, distributed network, including distributed ledger technology like block chain, is the foundation of peer-to-peer P2P processing.

Mesh networking, which enables a variety of devices, is a local network made up of objects called nodes that were initially intended to connect using radio waves. Every node on the network has the ability to communicate with every other node. Computing was frequently centralized on a single inexpensive desktop computer until the 1980s. However, modern computing resources computers or servers are frequently geographically dispersed over numerous locations, a situation where distributed networking shine. Some forms of computing, such as Very Large-Scale Instruction Words, become bottlenecked once parallelism and the benefits of better hardware reach a certain point. These bottlenecks are removed by expanding the quantity of computers rather than the strength of their individual components [2]. Distributed networking can also be helpful in situations where resource sharing is a problem or where a higher level of fault tolerance is required. Higher levels of anonymity are also extremely well supported by distributed networking.

DISCUSSION

The fundamental supply chain has been developed into a supply-chain network. A supply-chain network is what results when organizations with a basic supply chain evolve it into a more sophisticated structure containing a greater degree of interdependence and connectivity amongst more organizations as a result of rapid technology improvement. A supply-chain network can be used to demonstrate the flow of resources and information between organizations as well as to highlight interactions between different types of businesses. Supply-chain networks are typically structured with five core areas: external suppliers, manufacturing centers, distribution centers (DCs), demand zones, and transportation assets. These networks are now more global than ever. A supply-chain network, which is the

collection of physical locations, means of transportation, and auxiliary systems via which the products and services firm markets are managed and eventually supplied, can be built by any organization.

Manufacturing facilities, storage warehouses, carrier cross-docks, major distribution centers, ports, and intermodal terminals can all be physical locations in a supply-chain network, regardless of whether they are owned by a company, suppliers, transport carriers, third-party logistics providers, retail stores, or end users. A supply-chain network's various vehicle types, railways for boxcar or intermodal unit movement, container ships, and cargo planes are all examples of possible modes of transportation. Order management systems, warehouse management systems, transportation management systems, strategic logistics modelling, inventory management systems, replenishment systems, supply chain visibility, optimization tools, and more are just a few of the systems that can be used to manage and improve a supply-chain network. These supply chain networks can now be automated in real time using emerging technology and standards like RFID and the GS1 Global Standards, making them more effective than the previous, less complex supply chains.

Design of Supply Chain Networks

It has been indicated by experts that the location of facilities and the movement of product between the facilities account for 80% of supply chain expenses, therefore a supply-chain network can be deliberately constructed in order to lower the cost of the supply chain. Because a mathematical model can be developed to optimism the supply-chain network, supply chain network design is sometimes referred to as Network Modelling. Investing in the tools and resources to construct an enhanced supply chain network design that takes into consideration tax legislation, new entrants into their market, and resource availability has led to more complicated network designs among businesses [3]. The process of designing a SCN entails building a network that includes all the manufacturing equipment, buildings, goods, and vehicles that either belong to the organization or are not its property but are instantly necessary for supply-chain operations and product movement. Details on the quantity and location of facilities, such as plants, warehouses, and a supplier base, should also be included in the design.

Consequently, it is possible to define a SCN design as the union of nodes with capability and capacity connected by lanes to facilitate the movement of products between facilities. Organizations must make judgments on the procurement of transport based on data-driven supply chain network design and reliable freight data as data accessibility keeps getting better. Since the network footprint, capabilities, and capacity, as well as the product flow, are all intertwined and dependent on one another, there is no one set approach to design a SCN. Furthermore, there is no one perfect SCN architecture; instead, there appears to be a trade-off between responsiveness, risk tolerance, and efficiency when creating the network. Modern technologists point to the benefits of a linked ecosystem despite the limitations of a standard model's network design. An intricate web of incumbent companies operating along the supply-demand spectrum, including shippers, carriers, operators, brokers, etc. It serves as an online marketplace for loads and hauls when donned as a goods platform. The latest technological advancements that give platform users value-added services connect shippers and carriers to move goods [4]. With freight ecosystems, shippers are prepared to be close with their orders and carriers assume more asset control. Real-time visibility, ETA, and live status updates.

Supply-Chain Reverse Network Design

The environmental impact of end-of-life products has given rise to a new necessity for reverse supply-chain network design. This specific network architecture takes into account logistical concerns including the collecting, processing, and recycling of end-of-life products.

Companies that jointly construct the forward and reverse supply chains while keeping recycling and disposal in mind tend to succeed the most. This enables businesses to support products from manufacturing through disposal, so creating a closed-loop system.

Distribution's Part in the Supply Chain

Distribution is the process of moving and storing a product through the supply chain from the supplier stage to the customer stage. Every pair of stages in the supply chain have distribution in between them. While finished goods are transported from the producer to the end user, raw materials and components are transported from suppliers to manufacturers. Because distribution directly influences both the cost of the supply chain and the value of the customer, it is a major factor in a company's overall profitability. About 35% of the revenue in the clothes retail sector is impacted by distribution, including how it affects markdowns and lost sales. About 30% of the cost of making and selling cement in India goes towards its outward distribution. It wouldn't be overstating things to say that two of the most successful firms in the world, Wal-Mart and Seven-Eleven Japan, have built their whole enterprises around excellent distribution planning and execution. Wal-Mart's use of distribution enables the corporation to offer very affordable prices on a wide variety of relatively common products. Effective distribution offers a very high level of customer responsiveness in the instance of Seven-Eleven Japan at an affordable price.

There are two main stages to developing a distribution network. The supply chain network's general structure is illustrated in the first phase. Decisions like whether the product will be offered directly or via an intermediary are made during this phase. The general framework is then transformed into specific locations and their capability, capacity, and demand allocation in the second step. This chapter focuses on problems that affect how the broad distribution network is designed. The second phase, which begins with the wide network and ends with a particular supply chain network, is the subject of chapters 5 and 6. The right distribution network can be used to accomplish a range of supply chain goals, from high responsiveness to low cost. As a result, businesses in the same sector frequently choose various distribution networks. The challenges that arise when choosing between different distribution networks solutions are then covered using examples from the industry [5].

Up until that point, HP and other firms like Dell distributed their PCs through resellers, while Dell sold its products directly to end users. Customers of Dell had to wait several days to receive a computer, while those of HP could purchase a computer directly from a reseller. Dell also began selling its PCs through merchants like Wal-Mart in June 2007. Gateway built Gateway Country locations in the late 1990s so that customers could view the products and have salespeople assist them in customizing a PC to meet their needs. However, Gateway made the decision to not sell anything in the stores; all PCs were delivered to customers directly from the manufacturing. Due to bad financial results, Gateway closed all of its outlets by April 2004. In contrast, Apple Computer has opened numerous retail locations where computers are sold. These PC manufacturers have selected various models of distribution. How can we assess this variety of distribution options? Which ones are more beneficial to businesses and their clients? While requiring smaller players to purchase P&G products from wholesalers, P&G has chosen to distribute directly to major grocery chains.

When going to larger chains, products from P&G move directly there; but, when going to smaller supermarkets, they go through an additional stage. Texas Instruments, which formerly primarily employed direct sales, now sells around 30% of its volume to 98 percent of its customers through distributors while providing 70% of the volume directly to the other 2% of consumers.1 What kind of benefits do these distributors offer? When should a distribution network contain a distributor as a second stage? In comparison to the US, distributors are far more important in the distribution of consumer goods in countries like

India. What makes this possible? About 200,000 SKUs at W.W. Grainger are available for same-day shipping to clients. When a consumer placed an order, the remaining slower-moving goods are dispatched immediately from the manufacturer rather than remaining on hand. In this instance, it takes many days for the consumer to acquire the product. Are these distribution decisions suitable? How are they justified, exactly? The aforementioned examples show that companies have a wide range of options when establishing their distribution network. The demise of businesses like Blockbuster and Web van shows how a poor network may significantly harm a company's ability to make a profit.

The right distribution network option expands the supply chain surplus by meeting customer needs as cheaply as possible. We list the performance indicators that should be taken into account when developing the distribution network in the next section. The amount of time it takes for a customer to receive an order is known as the response time. The number of unique products/configurations that the distribution network offers is known as product variety. The likelihood that a product will be in stock when a client order is received is known as product availability. The simplicity with which customers may place and receive orders, as well as the degree to which this experience is customized, all contribute to the customer experience. It also includes elements that are merely sensory, such the chance to get a cup of coffee and the benefits that the sales personnel offer. Time to market refers to how long it takes to launch a new product. The capacity of customers to follow their orders from placement to delivery is known as order visibility. Return ability is the network's capacity to handle customer returns of defective goods and the simplicity with which a customer can do so. At first glance, a customer can appear to always demand the maximum degree of performance across all of these aspects.

However, this is not the case in actuality. When ordering a book from Amazon, customers are prepared to wait longer than those who choose to visit a nearby Barnes & Noble shop. As opposed to the Barnes & Noble location, buyers may find a significantly wider selection of books at Amazon.com. Customers on Amazon compromise between quick responses and a wide selection. Only a few sites, some of which may be far from the customer, are necessary for businesses that cater to clients that can accept a considerable reaction time. These businesses can concentrate on boosting capacity at each location. In contrast, businesses that cater to clients who seek quick responses must situate facilities close by. These businesses must have a large number of small-capacity facilities. For instance, Barnes & Noble delivers books to consumers the same day but needs hundreds of locations to do so across the majority of the United States [6].

Distribution Network Design Options

We go over distribution network options from the manufacturer to the final customer in this section. Many of the same possibilities are still available when thinking about distribution between any other two phases, such as supplier to manufacturer or even a service provider serving its clients through a distribution network. When creating a distribution network, managers must decide on two critical factors:

1. Will the merchandise be picked up from a prearranged place or delivered to the customer's location?
2. Will a middleman or intermediate location be involved in the product flow?

One of six different distribution network architectures may be employed to transport goods from the manufacturer to the customer, depending on the firm's business and the responses to these two questions. The following categories apply to these designs:

1. Manufacturer warehousing and shipping.
2. Manufacturer warehousing with immediate delivery and transit combine.

3. Storage at the distributor with carrier delivery.
4. Storage at the distributor with last-mile delivery.
5. Distributor manufacturer storage with consumer pickup.
6. Customer pickup and retail storage.

Storage by the manufacturer and direct shipping. This alternative avoids the retailer who takes the order and requests delivery by having the product transported directly from the manufacturer to the final consumer. Drop-shipping is another name for this choice. The store doesn't have any inventory. Information travels from the customer to the manufacturer to the retailer before being supplied directly to customers. Drop-shipping is a method used by online merchants like bags and Nordstrom.com to deliver products to customers. Few bags are kept in stock by bags. When it comes to slow-moving footwear, Nordstrom adopts the drop-ship approach and keeps some items in stock. Drop-shipping is another method used by W.W. Grainger to provide clients with slow-moving goods. The capacity to centralize inventory at the manufacturer, who can combine demand across all stores it supplies, is drop-shipping's major benefit is able to deliver high product availability with low inventory levels.

The ownership structure of the inventory at the manufacturer is a significant problem with regard to drop-shipping. Even when the inventory is physically aggregated, there is minimal value of aggregation if certain pieces of it are allotted to specific retailers by the manufacturer. Benefits of aggregation can only be realized if the producer can flexibly distribute among merchants at least some of the available inventory. The advantages of centralization are greatest when applied to high-value, low-demand goods with erratic demand. These requirements are met by Nordstrom's choice to drop-ship low-demand shoes. Similar to this, debags' bags typically have high values and low levels of demand per SKU. For products with predictable demand and low value, the inventory benefits of aggregation are minimal. Drop-shipping does not, then, provide a material inventory advantage to an online supermarket selling a basic commodity like detergent. If drop-shipping is employed in place of retail store storage for slow-moving items, inventory turns can rise by a factor of six or more.

The manufacturer has the option to delay customization until after a consumer has placed an order thanks to drop-shipping. If adopted, postponement reduces inventories even more by aggregating to the component level. Dell retains stocks as standard parts for its customized machines and delays product customization, which lowers the amount of inventory carried. Although the average outbound distance to the final consumer is long and package carriers are required to carry the product, drop-shipping has low inventory costs but high transportation costs. Compared to truckload or less-than-truckload carriers, package carriers have higher transportation expenses per unit. A client purchase from various manufacturers will require many shipments to the customer when drop-shipping is used. Costs go up as a result of this loss in outward transportation aggregation. Because all inventories are centralized at the manufacturer when drop-shipping is used, supply chains save on the fixed cost of facilities. As a result, the supply chain no longer requires additional warehousing space.

Because there is no longer a transition from producer to retailer, there may be some handling cost savings as well. However, because the manufacturer is now forced to transfer goods to the factory warehouse in full cases and subsequently ship out of the warehouse in single units, handling cost savings must be carefully considered [7]. A manufacturer's inability to create single-unit delivery capabilities might have a detrimental impact on handling costs and turnaround time. If the manufacturer has the option to dispatch orders directly from the manufacturing line, handling expenses can be greatly decreased. Even if the inventory is held by the manufacturer, a reliable information infrastructure is required between the retailers and the manufacturer so that the merchant may tell the customer of the product's availability.

Even if the order is placed with the merchant, the customer should be able to see how it is being processed at the manufacturer. Drop-shipping typically necessitates a substantial investment in the IT infrastructure.

Since the two stages store and manufacturer do not need to be connected, direct sellers like Dell have a slightly easier time meeting the information infrastructure requirement. Because the order must be transferred from the merchant to the manufacturer and shipping distances are typically longer from the manufacturer's centralized site, drop-shipping has a tendency to result in lengthy response times. According to bags, for instance, order processing could take up to five days, and ground delivery could follow in another three to eleven business days. This suggests that employing ground transportation and drop-shipping, the customer response time at debags will be 4 to 16 days. Another problem is that not all manufacturers included in a customer order must have the same response time. Customers will see many partial shipments over time when their order includes products from various sources, which makes receiving more challenging for them.

Every product at the producer can be made available to the client through a drop-shipping model without being constrained by shelf space. Using drop-shipping, W.W. Grainger can provide millions of sluggish-moving items from countless manufacturers. If W.W. Grainger had to store each item, this would be impossible. Drop-shipping makes it possible for a new product to hit the market the day it is made. Delivery to the customer's location is one way that drop-shipping offers a positive customer experience. However, the experience degrades when a single order that includes goods from multiple producers is shipped out in pieces. Due to the fact that every customer order goes through two stages of the supply chain, order visibility is crucial when discussing manufacturer storage. Customer satisfaction is likely to suffer significantly if this capacity is not offered.

However, because order tracking necessitates complete information system integration at both the merchant and the manufacturer, order tracking becomes more challenging to implement in a drop-ship system. Order visibility is easier to deliver for direct sellers like Dell. A manufacturer storage network may struggle to manage returns, which would lower customer satisfaction. Drop-shipping makes managing returns more expensive because each order could include shipments from multiple manufacturers [8]. There are two ways to handle returns. One option is for the customer to ship the product back to the creator. The second strategy entails the store setting up a unique facility to process returns across all manufacturers. While the second technique necessitates investment in a facility to manage returns, the first option has considerable transportation and coordination expenses.

Application

The following are some crucial ways that supply chain management is used in online sales:

1. **Inventory Management:** By maximizing inventory levels to fulfil customer requests while reducing holding costs and stock outs, effective supply chain management aids online businesses. Businesses may guarantee product availability and prevent excess inventory or shortages by putting inventory management systems and demand forecasting strategies into practice.
2. **Order Fulfilment:** In online sales, supply chain management facilitates effective order fulfilment procedures. To ensure precise and on-time deliveries, it involves coordinating tasks including order processing, picking, packaging, and shipping. Order fulfilment is expedited and automated thanks to sophisticated order management systems, warehouse management systems, and transportation management systems.
3. **Warehouse and Distribution:** To make sure that products are available for prompt dispatch, online sales necessitate effective warehouse and distribution operations. To reduce handling time and increase order processing speed, supply chain management can

help optimism warehouse structure, storage systems, and picking procedures. Additionally, through efficient route planning and carrier selection, good distribution management guarantees on-time delivery to customers.

4. **Last-Mile Delivery:** A crucial component of internet sales is last-mile delivery. By taking into account elements like delivery routes, transportation options, and consumer preferences, supply chain management aids in the optimization of the last-mile delivery process. A fast and convenient product delivery ensured by effective last-mile transportation increases customer satisfaction.
5. **Reverse Logistics:** Returns and exchanges are frequent in the internet retail setting. Management of product returns, repairs, and swaps enables effective reverse logistics procedures. Businesses may streamline the reverse logistics process, lower costs, and deliver smooth customer experiences by putting in place efficient returns management solutions.
6. **Customer Service and Communication:** As part of supply chain management, customers are informed clearly and promptly about order status, shipment status updates, and delivery notifications. Businesses may give accurate and timely information to customers through effective supply chain management, increasing transparency and customer satisfaction [9].

CONCLUSION

In the context of online sales, developing distribution networks is of utmost importance. The effective design of distribution networks is essential for fulfilling the special requirements and problems of e-commerce, such as the need for easy returns and exchanges and reduced delivery times. Businesses can carefully analyse network structure, site choices, transportation options, and inventory positioning to optimism their distribution networks for online sales. This facilitates quicker order fulfilment, enhances last-mile delivery, lowers costs, and improves client happiness. Distribution network design is made even more successful by utilizing technology, data analytics, and working with logistics partners.

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CHAPTER 8

MANUFACTURER STORAGE: DIRECT SHIPPING AND IN-TRANSIT MERGE

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ABSTRACT:

An innovative supply chain method known as manufacturer storage with direct shipment and in-transit merging combines aspects of warehousing and transportation to boost operational effectiveness and optimism inventory management. This chapter gives a summary of this strategy while highlighting its salient characteristics and advantages. With this tactic, producers keep their own facilities for storing produced goods, cutting down on lead times and enhancing customer responsiveness. Simultaneously, manufacturers use in-transit merge processes, where several shipments are combined and merged during transportation, as opposed to transporting goods directly to distribution centers or retailers.

KEYWORDS:

Distributor Storage, In Transmit Merging, Infrastructure, Manufacture Storage, Pickup.

INTRODUCTION

In-transit merge merges parts of the order coming from several locations so that the client receives a single delivery, as opposed to pure drop-shipping, when each item in the order is shipped straight from its producer to the final customer. Dell used in-transit merging, and drop-shipping businesses can also use it. The package carrier picks up the PC from the Dell plant and the monitor from the Sony factory when a customer orders a PC from Dell together with a Sony monitor. It then combines the two at a hub before making a single delivery to the consumer. Similar to drop-shipping, an important benefit of in-transit merging is the capacity to combine inventories and delay product personalization. Dell and Sony are able to keep all of their inventory at the facility thanks to the in-transit merging. The advantages of this strategy are greatest for high-value products whose demand is unpredictable, especially if product modification may be delayed. Merge in transit lowers transportation costs in comparison to drop-shipping by aggregating the ultimate delivery, despite the need for more coordination.

The manufacturer's and the retailer's facility and processing charges are comparable to drop-shipping costs. Due to the merging capabilities needed, the party performing the in-transit merge has greater facility expenses. A single delivery results in decreased receiving expenses for the customer. Compared to drop-shipping, overall supply chain facilities and handling expenses are a little higher. To enable in-transit merging, a sophisticated information infrastructure is required. Along with information, coordination of activities at the retailer, the manufacturer, and the carrier is also necessary. When compared to drop-shipping, there is a bigger investment in the information infrastructure [1]. Drop shipping is similar in terms of response times, product diversity, accessibility, and time to market. Due to the necessity of performing the merge, response times can be slightly longer. Because the consumer receives a single delivery for an order rather than numerous partial shipments, the customer experience is probably better than with drop-shipping. Visibility of orders is a crucial necessity.

The integration of the maker, carrier, and merchant is complex during the first setup, but tracking is made simpler by the merge at the carrier hub. Return handling issues are expected, and the reverse supply chain will remain costly and challenging to implement, similar to drop-shipping. The performance of factory storage with in-transit merging and drop-shipping are contrasted. Lower transportation costs and a better customer experience are in-transit merge's favor over drop-shipping. The extra work required for the merge itself is the main drawback. Manufacturer storage with in-transit merging is most appropriate for low- to medium-demand, high-value products that the retailer sources from a select few manufacturers given its performance characteristics. In-transit merge requires more demand from each manufacturer not necessarily from each product than drop-shipping in order to be successful. It can be challenging to plan and carry out in-transit merge when there are too many sources. When there are just four or five sourcing locations, in-transit combine works best [2], [3] The in-transit merger of a Dell PC and a Sony monitor is appropriate since there are few sourcing locations with relatively high total demand from each sourcing location, despite the considerable product variation.

Storage at the Distributor and Delivery by Carrier

In this scenario, distributors and retailers hold inventory rather than producers at the facilities, and package carriers are utilised to get goods from the intermediate location to the final consumer. This strategy in conjunction with drop-shipping from a manufacturer has been employed by Amazon and industrial distributors like W.W. Grainger and McMaster-Carr. The information and product flows while using distributor storage and package carrier delivery. Because there is a loss of aggregation compared to manufacturer storage, distributor storage demands a higher volume of inventory. Distributor storage makes sense from an inventory standpoint for goods with a tad higher demand. This is evident in the ways that both Amazon and W.W. Grainger do business. They store only products that move slowly too quickly in their warehouses, with extremely slow-moving items being stored further upstream. With distributor storage, product diversification can sometimes be delayed, but doing so does necessitate that the warehouse acquires certain assembly capabilities. However, distributor storage uses a lot less space.

A retail network has less inventory. When using warehouse storage, Amazon turns its inventory through roughly 10 times a year, while Barnes & Noble only goes through about 3 times. Since the warehouse, which is closer to the client, may receive inbound goods using a cost-effective mode of transportation such as truckloads, distributor storage has somewhat lower transportation costs than manufacturer storage. Distributor storage allows outbound orders to the customer to be combined into a single shipment, further lowering transportation costs, in contrast to manufacturer storage, which may need many shipments to be sent out for a single customer order including multiple goods. Compared to manufacturer storage, distributor storage offers savings on the transportation of items with higher rates of movement. Due to a loss of aggregation, facility costs of warehousing for distributor storage are a little bit more than for manufacturer storage. Costs associated with processing and handling are comparable to those associated with manufacturer storage unless the factory is able to ship straight to the final consumer from the manufacturing line. Then, distributor storage has more expensive processing expenses. Distributor storage is not recommended for exceptionally slow-moving commodities from a facility cost viewpoint [4].

Distributor storage requires a substantially less complicated information architecture than manufacturer storage. In order to reduce the requirement for perfect coordination between the manufacturer and the client, the distributor warehouse acts as a barrier. While real-time visibility between the client and the manufacturer is not necessary, it is required between the customer and the warehouse. Real-time visibility between the client and manufacturer cannot be obtained at a lower cost than visibility between the distributor warehouse and

manufacturer. Because distributor warehouses, on average, are closer to consumers and the entire order is aggregated at the warehouse before being dispatched, response time under distributor storage is better than under manufacturer storage. For instance, Amazon processes the majority of warehouse-stored items in a day, and it takes the client three to five business days to get their order via ground transportation. W.W. Grainger processes client orders the same day and has enough warehouse space to use ground transportation to deliver the majority of orders the following day.

A certain amount of product variation is constrained by warehouse storage. W.W. Grainger relies on manufacturers to drop-ship those products to customers instead of keeping them in stock at its warehouse [5], [6]. Because a single shipment is sent to the client in response to an order, distributor storage offers a high level of consumer convenience. Due to the requirement to stock at a different point in the supply chain, distributor storage requires a somewhat longer time to market than producer storage. Because there is only one shipment from the warehouse to the customer and only one stage of the supply chain is directly involved in fulfilling the customer order, order visibility is made easier than with manufacturer storage. Because all returns may be processed at the warehouse, return ability is better than with manufacturer storage. Even if the goods come from various producers, the consumer just needs to return one package.

DISCUSSION

Last-Mile Delivery Combined with Distributor Storage In contrast to utilizing a package carrier, last-mile delivery is when the distributor or retailer brings the product directly to the customer's home. In the supermarket sector, companies including Web van, Peapod, and Albertsons have used last-mile delivery. Amazon has introduced local express delivery to offer customers same-day delivery. Home delivery networks for a range of products were attempted by businesses like Cosmo and Urban fetch, but they failed to succeed. The distributor storage with last-mile delivery model predominates in the automotive spare parts sector. Dealers cannot afford to stock every replacement part they might need. Therefore, original equipment manufacturers (OEMs) frequently stock the majority of spare parts at a regional distribution hub that is frequently run by a third party and is typically just a few hours' drive from their dealers. The neighborhood distribution center is in charge of making many deliveries each day to a group of dealers in order to distribute the required parts. For last-mile delivery, which differs from package carrier delivery, the distributor warehouse must be located significantly nearer to the customer. More warehouses are needed than when package delivery is used because of the last-mile delivery's restricted service area.

Because it has a lesser level of aggregation than the other choices, distributor storage with last-mile delivery demands higher levels of inventory. When it comes to inventory, warehouse storage with last-mile delivery works well for relatively fast-moving goods that must be delivered right away and for which some degree of aggregation is advantageous. Car dealers' needs for auto parts meet this criterion. Transportation expenses for last-mile delivery are the greatest across all distribution networks, particularly when shipping to single customers. This is so that package carriers, who consolidate deliveries across numerous stores, can benefit from greater economies of scale than distributors and retailers trying last-mile delivery. Costs of delivery grocery business. In large, congested cities, last-mile delivery may be a little less expensive. Bulky products with eager customers who are willing to pay extra for home delivery may also be justified in incurring transportation expenditures. In China, where there is a high population density, home delivery of water and large bags of rice has been quite successful and helped keep delivery costs down.

In situations where the consumer buys in big quantities, the transportation expenses of last-mile delivery are best justified. Individual customers seldom experience this, but

organizations like auto dealerships may justify daily delivery since they often buy big quantities of spare parts. Bulky commodities like five-gallon water jugs in the US and huge bags of rice in China can be justified for home delivery to specific clients. Last-mile delivery is more affordable and practical than clients picking up their own bottles or bags in each case. When choosing this option, facility expenses are somewhat higher than those for manufacturer storage or distributor storage with package carrier delivery, but considerably lower than those for a network with retail outlets. However, because there is no client engagement, processing costs are significantly greater than for a network of retail establishments. Contrary to supermarkets, where the customer must conduct much more effort, a food store implementing last-mile delivery handles all processing up until the product is delivered to the client's home [7].

Similar to distributor storage with package carrier delivery, last-mile delivery uses a similar information infrastructure. Response times are faster than employing package carriers, but it also requires the capacity to schedule delivery. While online grocers normally offer next-day delivery, Cosmo and Urban fetch attempted to offer same-day delivery. In comparison to distributor storage with carrier delivery, the product selection is typically lower. The price to provide goods availability is higher than the price for any alternative other retail outlets. Customers may enjoy choosing this option, especially for large, difficult-to-carry items. Due to the new product's need to penetrate further before it is made available to customers, time to market is much longer than for distributor storage with package carrier delivery. Given that deliveries are done within 24 hours, the issue of order visibility is less of a concern.

When an order is incomplete or not delivered, the order-tracking feature is crucial for handling exceptions. The benefit of return ability with last-mile delivery outweighs the disadvantages of the other choices because delivery trucks can also pick up returns from customers. Even said, handling returns is still more expensive than doing it in a physical store where a client can bring the item back. Provides a summary of the performance parameters of distributor storage with last-mile delivery. It is challenging to defend last-mile delivery to specific customers on the grounds of efficiency or increased profit in regions with high labor expenses. Only if there is a sizable enough client base that is willing to pay for this convenience can it be justified. To take advantage of economies of scale and boost utilization, an attempt should be made to combine last-mile delivery with an existing distribution network. One instance is Albertsons' utilization of current groceries.

Utilizing shop resources and staff to offer home delivery. The grocery store has a section that fulfils online orders and functions as a replenishing point for the actual grocery store. This increases utilization while reducing the cost of offering the service. If client orders are sufficient to allow for certain economies of scale and customers are prepared to pay for this convenience, last-mile delivery may be justified. To take into account this concept, Peapod updated its price guidelines. Delivery fees reduce to $6.95 for transactions totaling more than $100 and are $9.95 for orders with a minimum of $60. Based on how its schedule looks, Peapod gives discounts for deliveries at times when demand is lower. When a company, such as an auto dealer, is the customer and is buying in bulk, last-mile delivery is simpler to explain.

Storage by Manufacturer or Distributor for Customer Pickup

This method involves keeping inventory at the manufacturer's or distributor's warehouse while having customers place their orders online or over the phone and pick up their purchases at designated locations. Orders are transported as needed from the storage location to the pickup locations. Examples of websites that enable customers to pick up online orders at a specific shop include dream.com and Otoriyose-bin, both of which are run by Seven-Eleven Japan. W.W. Grainger is a business-to-business (B2B) example, whose clients can

pick up their orders at one of the W.W. Grainger retail locations. While some products may come from a central location, others may be stored at the pickup point. The order is delivered from a manufacturer's or distributor's warehouse to the pickup place in the instance of dream.com.

The Site to Store service, which allows customers to order thousands of products online at Walmart.com and have them transported for free to a nearby Wal-Mart store, was introduced by Wal-Mart in 2007. After an order is processed, the items usually appear in stores within 7 to 10 business days [8], [9]. Customers are notified via email when their purchase is prepared for pickup. Every day, merchandise from manufacturers is cross-docked and delivered to retail locations. It is possible to treat an online shop delivering an order through Seven-Eleven as one of the manufacturers, with deliveries being cross-docked and delivered to the proper Seven-Eleven location. By acting as a delivery point for online orders, Seven-Eleven can make better use of its current logistical resources.

This method allows for minimal inventory costs by utilizing aggregation through manufacturer or distributor storage. Fast-moving items are kept in stock at pickup sites by W.W. Grainger, whereas slow-moving items are kept in stock at a central warehouse or, in some cases, the manufacturer. Due to the possibility of considerable order aggregation when delivering orders to a pickup location, transportation costs are lower than for any option utilizing package carriers. This enables the delivery of orders to the pickup location using truckload or less-than-truckload carriers. Given that trucks already deliver goods to the stores, integrating online purchases will only result in a minor marginal increase in transportation costs for a business like Seven-Eleven Japan. Consequently, Seven-Eleven Japan enables consumers to pick up orders free of charge.

If additional pickup sites must be created, facility expenses will be significant. The additional facility expenditures can be reduced by finding a solution using existing sites. This is true, for instance, of dream.com, Wal-Mart, and W.W. Grainger, for which there are already physical locations. The manufacturer's or the warehouse's processing fees are equivalent to those of other solutions. Because each order must be matched with a specific consumer when they arrive, processing costs at the pickup location are expensive. If adequate storage and information systems are not available, developing this capability could considerably increase processing costs. The largest barrier to the success of this strategy is the increased processing cost and potential for mistakes at the pickup location.Up until the customer picks up the order, visibility of the order requires a sizable information infrastructure. The merchant, the storage facility, and the pickup location must work well together. In this situation, a response time that is on par with using package carriers is possible.

Storage options might be offered with a selection and availability comparable to those of any manufacturer or distributor. Because clients must pick up their own orders, as opposed to the other options mentioned, there is some loss of the customer experience. On the other side, clients who choose not to pay online can use this option to pay with cash. It can be claimed that the inconvenience to customers is minimal in nations like Japan, where Seven-Eleven has more than 10,000 locations, because the majority of customers live close to a pickup location and can pick up an order whenever it's convenient for them. This choice is sometimes thought of as more practical because it does. Not need the client to be home to receive the delivery. With manufacturer storage, new product time to market can be as quick as possible. For customer pickups, order visibility is crucial. Once the item has arrived, the customer must be notified, and the order must be clearly visible when the customer comes to pick it up.

Due to the need for supply chain integration at many levels, such a system is challenging to develop. Customers' lives will be made easier if returns may possibly be handled at the

pickup location. From a transportation standpoint, delivery trucks can manage return flows. The performance parameters of manufacturer or distributor storage with consumer pickup locations are enumerated. The ability to reduce delivery costs and increase the variety of products sold and clients served online are the key benefits of a network with consumer pickup locations. The main obstacle is the pickup site's higher handling costs and complexity. Due to the fact that this kind of network increases the economies from existing infrastructure, it is likely to be most effective if current retail establishments are utilised as pickup places. Such a network can be particularly useful for companies like Seven-Eleven Japan, Wal-Mart, and W.W. Grainger, which operate both an offline network of stores and an online store. A customer-specific order must be able to be picked on these retail sites, which is unfortunate because they are often meant to let customers do the picking.

Retail Storage and Client Pickup

Inventory is kept locally at retail establishments in this approach, which is frequently seen as the most conventional supply chain design. Customers can stroll into the retail store, order over the phone or online, and pick it up there. Albertsons, which splits its space between an online fulfilment center and a grocery store, is an example of a business that provides customers with a variety of order placement choices. Both in-person and online orders are accepted from customers. A B2B illustration is W.W. Grainger. Customers can place an order via the company's website, over the phone, or in person, then pick it up at one of its retail locations. W.W. Grainger stores some things at pickup locations, while Albertsons keeps its inventory there as well. Other items might come from a central location. Due to the absence of aggregation, local storage drives up inventory costs. However, even with local storage, there is a slight increase in inventory for fast- to very fast-moving products. Because most of its products are rather quick-moving and are in any case stocked at the supermarket, Albertsons uses local storage.

Similar to this, W.W. Grainger stocks its fast-moving merchandise at pickup sites while its slow-moving product is kept at a central warehouse.Due to the availability of inexpensive modes of transportation for product replenishment at the retail store, transportation costs are significantly lower than with alternative methods. The need for numerous neighborhood facilities drives up facility expenses. If clients place orders when they enter the business, a basic information infrastructure is required. To give visibility of the order up until the consumer picks it up, however, a sizable information infrastructure is required for online orders. Because of local storage, this system can achieve fast response times. For instance, same-day pickup from retail locations is a service provided by both Albertsons and W.W. Grainger. The variety of products kept locally is less than it would be with other possibilities.

Providing a high level of product availability is more expensive than with any other possibilities. Whether or not a customer wants to shop affects the customer experience. Because the new product must pass through the complete supply chain before it is made available to customers, this option has the longest time to market. When placing purchases over the phone or online, order visibility is crucial for client pickups. At the pickup location, returns can be handled. Overall, return ability with this choice is ok.Provides a summary of the network performance characteristics for a system with local retail storage and customer pickup locations. The fundamental benefit of a network with retail storage is that it can deliver goods more cheaply and quickly than other networks. The increasing expenditures for facilities and inventory are the main drawback. A network like this works best for products that move quickly or for which customers seek quick responses.

A Distribution Network Design is Chosen

When choosing the best distribution network, a network designer must take both network requirements and product features into account. The numerous networks previously taken

into account each have unique strengths and shortcomings. The multiple delivery networks are compared to one another along various performance criteria. The best performance along a given dimension is indicated by a rating of 1, and when the relative performance declines, the ranking number rises. Only specialized businesses ultimately rely on a single distribution network. The ideal solution for the majority of businesses is a combination of delivery networks. The combination chosen is determined by the nature of the product and the strategic position the company is aiming for.

W.W. Grainger's distribution network, which incorporates all of the aforementioned choices, is a great illustration of a hybrid network. However, the network is adapted to the features of the good and the requirements of the client. Depending on the urgency, clients can choose to pick up locally stocked quick-moving and emergency items in person or have them sent. The customer receives their order within a day or two after it is dispatched from a national DC that stocks slower moving items. Usually drop-shipped from the manufacturer, very slow-moving items have a longer lead time. Amazon, which keeps fast-moving items at the majority of its warehouses, slower moving things at fewer warehouses, and extremely slow-moving items may be drop-shipped from distributors or publishers, uses a different hybrid network.

The examples from the computer industry that were mentioned at the beginning of the chapter can now be reviewed. It was a mistake for Gateway to build a network of retail locations without taking advantage of the supply chain benefits such a network may provide. Gateway should have stocked its basic configurations, which are expected to be in high demand, in the retail stores and drop-shipped all other configurations from the manufacturer perhaps with local pickup at the retail stores if it was cost-effective in order to fully utilize the advantages of the retail network. Instead, its factory-drop-shipped every configuration. Apple has opened a number of retail locations, and these locations actually have goods for sale. Given the limited selection and high demand for Apple products, this makes sense. In actuality, Apple's retail stores have consistently generated more sales and profits.

Effect of Online Sales on Computer Hardware Customer Service

The delay in completing the customer's order is the major drawback for Dell of selling hardware online. While a longer response time is not a significant drawback for expensive, customized hardware, Dell will suffer when trying to offer its low-cost, standardized configurations online. For specialized hardware, Dell is able to take advantage of the majority of the responsiveness-improving opportunities provided by the Internet. The business makes a large range of personalized PC setups with the required processor, RAM, hard disc, and other components available online. By providing clients with a solution that comes close to meeting their unique needs, customization enables Dell to please customers. Because it is simple to display the customization possibilities online, Dell can draw clients that appreciate this freedom. To make it easier for large business customers to place purchases, Dell also employs customized Web pages.

It is obvious that all of these skills are less useful for standardized configurations. Companies like Dell and Apple can launch new goods quickly thanks to the Internet. This is crucial in the computer and cell phone industries where goods have brief, few-month lifespans. The retail channel requires the complete supply chain to be stocked before buyers can access the goods, in contrast to the Internet, which allows a new product to be offered as soon as it is made.Based on product availability and demand, businesses like Dell are now able to adjust prices rapidly and effectively. The internet channel enables Dell to serve clients at a considerably lower cost than retail stores because it is open 24/7. Selling online enables Dell to get money for its gear within a few days after it has been purchased. However, Dell follows the more conventional payment schedules, where payment is required in weeks for

example, 30 days. Dell can run its business with negative working capital due to its low inventory levels and the fact that it receives payment for its hardware around 44 days before it pays its component suppliers. These outcomes are not possible with a hardware supply chain that includes wholesalers and retailers.

Online Sales' Effect on PC Industry Costs

Inventory expenses. Unlike a chain of retail stores selling computers, which must maintain inventory in each location, Dell's online sales allow it to consolidate its stocks into a small number of locations. By taking advantage of the time that passes between the point at which an online order is received and the point at which it must be shipped, Dell is able to further reduce inventory. All components for which clients are offered customization can be put together quickly because to the way Dell products and production lines are made. Dell is able to do this by keeping component inventories on hand and delaying assembly until after the customer order has been placed.

Dell can considerably lower inventories thanks to postponement and component commonality.Observe that, in contrast to low-value, standardized configurations with big and predictable demand, inventory reduction through aggregation and postponement is significantly more substantial for high-value, customized configurations with low and unpredictable demand. Facilities Fees. Because Dell only has to pay for the cost of the production facility and component storage space, the online channel enables the Dell supply chain to incur cheaper facility costs than the retail channel. A brick-and-mortar retail chain must pay for both the retail outlets and the distribution centers. Due to the fact that customers complete all of the work when placing an order online, Dell may benefit from customer involvement and reduce the expense of call center agents [10].

CONCLUSION

An effective supply chain solution that offers considerable benefits for businesses looking to optimism inventory management and boost operational efficiency is manufacturer storage with direct shipment and in-transit merging. This strategy enables manufacturers to shorten lead times, improve responsiveness, and streamline their supply chain procedures by merging parts of warehousing and transportation. Utilizing manufacturer-owned storage facilities reduces costs and improves cost-effectiveness by removing the requirement for large amounts of warehousing space. Utilizing in-transit merging procedures makes it easier to consolidate and route shipments, which lowers transportation costs and makes better use of available resources.

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CHAPTER 9

APPLICATION OF NETWORK DESIGN IN SUPPLY CHAIN MANAGEMENT

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ABSTRACT:

Demand and supply planning, production and capacity, vendor scheduling, and shipping and logistics are the six important applications of supply chain management. Here's a closer look at each. In order to optimism the movement of goods, information, and resources, network design is a crucial process in supply chain management. It entails strategically creating and configuring the network of facilities, distribution centers, warehouses, and transportation routes. The main goals, factors, and advantages of network design in supply chain management are highlighted in this chapter. Establishing an effective network that matches consumer demand while reducing overall supply chain costs is the main goal of network architecture.

KEYWORDS:

Chain Network, Chain Management, Facility, Network Design, Supply Chain.

INTRODUCTION

The fundamental supply chain has been developed into a supply-chain network (SCN). A supply-chain network is what results when organizations with a basic supply chain evolve it into a more sophisticated structure containing a greater degree of interdependence and connectivity amongst more organizations as a result of rapid technology improvement. A supply-chain network can be used to demonstrate the flow of resources and information between organizations as well as to highlight interactions between different types of businesses. Supply-chain networks are typically structured with five core areas: external suppliers, manufacturing centers, distribution centers (DCs), demand zones, and transportation assets. These networks are now more global than ever.A supply-chain network, which is the collection of physical locations, means of transportation, and auxiliary systems via which the products and services firm markets are managed and eventually supplied, can be built by any organization.

Manufacturing facilities, storage warehouses, carrier cross-docks, major distribution centers, ports, and intermodal terminals can all be physical locations in a supply-chain network, regardless of whether they are owned by a company, suppliers, transport carriers, third-party logistics providers, retail stores, or end users. A supply-chain network's various vehicle types, railways for boxcar or intermodal unit movement, container ships, and cargo planes are all examples of possible modes of transportation.

Order management systems, warehouse management systems, transportation management systems, strategic logistics modelling, inventory management systems, replenishment systems, supply chain visibility, optimization tools, and more are just a few of the systems that can be used to manage and improve a supply-chain network [1], [2]. These supply chain networks can now be automated in real time using emerging technology and standards like RFID and the GS1 Global Standards, making them more effective than the previous, less complex supply chains.

Design of Supply Chain Networks

It has been indicated by experts that the location of facilities and the movement of product between the facilities account for 80% of supply chain expenses, therefore a supply-chain network can be deliberately constructed in order to lower the cost of the supply chain. Because a mathematical model can be developed to optimism the supply-chain network, supply chain network design is sometimes referred to as Network Modelling. Investing in the tools and resources to construct an enhanced supply chain network design that takes into consideration tax legislation, new entrants into their market, and resource availability has led to more complicated network designs among businesses. The process of designing a SCN entails building a network that includes all the manufacturing equipment, buildings, goods, and vehicles that either belong to the organization or are not its property but are instantly necessary for supply-chain operations and product movement. Details on the quantity and location of facilities, such as plants, warehouses, and a supplier base, should also be included in the design. Consequently, it is possible to define a SCN design as the union of nodes with capability and capacity connected by lanes to facilitate the movement of products between facilities.

Organizations must make judgments on the procurement of transport based on data-driven supply chain network design and reliable freight data as data accessibility keeps getting better.Since the network footprint, capabilities, and capacity, as well as the product flow, are all intertwined and dependent on one another, there is no one set approach to design a SCN. Furthermore, there is no one perfect SCN architecture; instead, there appears to be a trade-off between responsiveness, risk tolerance, and efficiency when creating the network. Modern technologists point to the benefits of a linked ecosystem despite the limitations of a standard model's network design. An intricate web of incumbent companies operating along the supply-demand spectrum, including shippers, carriers, operators, brokers, etc. It serves as an online marketplace for loads and hauls when donned as a goods platform. The latest technological advancements that give platform users value-added services connect shippers and carriers to move goods. With freight ecosystems, shippers are prepared to be close with their orders and carriers assume more asset control. Real-time visibility, ETA, and live status updates.

Supply-Chain Reverse Network Design

The environmental impact of end-of-life products has given rise to a new necessity for reverse supply-chain network design. This specific network architecture takes into account logistical concerns including the collecting, processing, and recycling of end-of-life products. Companies that jointly construct the forward and reverse supply chains while keeping recycling and disposal in mind tend to succeed the most. This allows businesses to support products from manufacturing through disposal, so creating a closed-loop system.

Analysis of the Supply-Chain Network Risk

Although creating a supply-chain network might help a business save money, it's crucial to remember that the chain is constantly evolving and can adapt to changing conditions. Making sure the supply-chain network is adaptable enough to handle future uncertainty is a crucial component of network architecture [3]. Even if there is inherent uncertainty about the future, it is possible to undertake a supply chain network risk analysis and characterize the future business environment using the facts now at hand. There are two types of uncertainties related to supply-chain networks endogenous uncertainty and exogenous uncertainty.

Endogenous Ambiguity

When the source of the risk is found within the supply-chain network itself, such as with market volatility or technical instability, an uncertainty is said to be endogenous.

Exogenous Ambiguity

When a risk originates somewhere outside of the supply-chain network, it is said to be exogenous, or external to the network. Exogenous uncertainty can be further subdivided into continuous risks, which refer to continual dangers like economic volatility. 'Discrete' events are uncommon occurrences, like natural disasters, that potentially cause supply-chain disruptions.

Management of Risk

An organization can choose the optimum method for risk management by differentiating between these different kinds of uncertainty. A company's ability to stop external uncertainty is extremely constrained. By being well-prepared for potential incidents, the risk to the supply-chain network can be reduced. With precautions such as regular communication between an organization and supplier, endogenous uncertainty can be somewhat reduced.

DISCUSSION

The location of facilities connected to manufacturing, storage, or transportation, as well as the allocation of capacity and markets to each facility, are all decisions that are made during the construction of the supply chain network. Various supply chain network design choices fall into the following categories. The first question is:

1. What function should each facility serve? What operations are carried out in each facility?
2. The location of amenities. Where should facilities be situated?
3. How much should be allotted to each facility in terms of capacity?
4. Distribution of supplies and markets. Which markets should each facility target? Which sources of supply should each facility receive?

The configuration of the supply chain and the limits they impose on how the other supply chain drivers may be employed to either reduce supply chain cost or boost responsiveness have a substantial impact on performance. All decisions regarding network design must take into account how they all interact. The decisions made on each facility's function are important because they affect how flexible the supply chain can be in modifying how it fulfils demand. For instance, Toyota operates factories in every market it services. Each facility could only supply the local market before 1997. When the Asian economy experienced a recession in the late 1990s, Toyota suffered as a result. There was excess demand in other markets, but the local plants in Asia had idle capacity that was unable to be exploited. Each facility at Toyota has been made more adaptable so that it can serve markets other than the local one. With more flexibility, Toyota is better able to adapt to the shifting conditions of the worldwide market. Similar to this, Honda's ability to produce both cars and SUVs at the same facility in the United States was advantageous in 2008, when small car demand remained stable despite a decline in SUV demand.

Because it is expensive to close down a facility or transfer it, site considerations have an impact on a supply chain's performance over the long term [4], [5]. An effective location choice can increase a supply chain's responsiveness while lowering its costs. For instance, Toyota began constructing new facilities in the United States in 1988 after establishing its first one in Lexington, Kentucky. When the yen strengthened and automobiles made in Japan were too expensive to be cost competitive with cars made in the United States, Toyota's U.S. operations proved lucrative. Toyota was able to respond quickly to the American market while keeping costs down thanks to local plants. While location decisions are more easily changed than capacity allocation, capacity decisions do have a tendency to last for a number of years. A location's utilization suffers when it is given an excessive amount of capacity,

which raises costs. If demand is not met, there will be poor response time, and if a remote facility fills the need, there will be a high cost.

Because it influences the entire production, inventory, and transportation expenses spent by the supply chain to satiate client demand, the allocation of supply sources and markets to facilities has a substantial impact on performance. In order to adjust the allocation if production and transportation costs, market conditions, or plant capabilities change, this choice should be reviewed frequently. Of course, the distribution of markets and supply sources can only be altered if the facilities are adaptable enough to service a variety of markets and sources. As market conditions change or when two organizations join, decisions about network design must be reviewed. For instance, in order to reduce shipping costs and boost responsiveness, Netflix installed around 60 DCs across the United States by 2010 as its subscriber base increased. Netflix anticipated closing several of its DCs as the demand for DVD rentals started to decline due to the rise in online video streaming and the associated decline in DVD rentals.

Maintaining Netflix's low costs and responsiveness has required constant changes to the placement and demand allocation of DCs.Due to overlaps and variations in the markets that each of the two distinct businesses served before the merger, merging some facilities and modifying the location and function of others can frequently assist in lowering costs and improving responsiveness. Decisions about network architecture may also need to be reviewed if the cost of a factor, such as transportation, has drastically changed. P&G declared in 2008 that it will reconsider its distribution system, which was put in place when the cost of oil was $10 per barrel. We concentrate on creating approaches and a framework that can be applied to supply chain network design [6].

Factors Impacting Decisions Related to Network Design

In this section, we look at a wide range of variables that affect supply chain network design decisions. The supply chain network design choices made by a company are significantly influenced by its competitive strategy. The lowest cost location for manufacturing facilities is typically found by businesses who priorities cost leadership, even if that site is remote from the markets they serve. By placing their plants in low-cost nations like China, electronic manufacturing service providers like Falcon and Flextronics have been successful in offering affordable electronics assembly.

In contrast, businesses that priorities responsiveness typically situate facilities nearer to the market and may opt for more expensive location if doing so enables the business to respond rapidly to the changing demands of the market. Despite the greater costs, the Spanish clothing manufacturer Zara produces a sizable portion of its products in Portugal and Spain. The corporation can react swiftly to shifting fashion trends in Europe because to its local capability. Due to its responsiveness, Zara has become one of the world's garment retailers with the highest rate of growth.

As part of their competitive strategy, chains of convenience stores strive to make their stores simple for customers to access. Thus, convenience store networks consist of a large number of tiny establishments that collectively span a large area. Discount retailers, like Sam's Club or Costco, on the other hand, focus on offering low pricing as part of their competitive strategy.

Customers frequently have to travel great distances to one of their networks' major stores because of this. One Sam's Club location may serve a large portion of the local convenience store market. The ideal way for global supply chain networks to meet their strategic goals is with facilities in many nations playing various roles. For instance, Zara has both European and Asian production plants. Its Asian production plants priorities cheap costs and generally

provide standardized, low-value goods that are widely consumed. The European facilities priorities responsiveness and develop innovative ideas whose demand is erratic. With this combination of resources, Zara is able to produce a wide range of goods in the most efficient way.

Technical Aspects

The characteristics of production technologies that are currently available have a big influence on network architecture choices. A few high-capacity locations are most efficient when production technology exhibits large economies of scale. This is true for the production of computer chips, which calls for expensive factories yet relatively cheap transportation of the finished product. As a result, the majority of semiconductor businesses construct a small number of large facilities. In contrast, many local facilities are chosen when they have lower fixed costs as this helps to reduce transportation expenses. For instance, Coca-Cola bottling plants do not have significant fixed costs [7]. Coca-Cola establishes numerous bottling facilities around the world, each serving a specific local market, to cut down on transportation expenses. Taxes, tariffs, exchange rates, and transportation expenses are examples of macroeconomic issues that are external to a certain company. Macroeconomic variables have significantly impacted the success or failure of supply chain networks as global trade has grown. Therefore, it is crucial that businesses consider these aspects when making decisions on network architecture.

Tariffs and Tax Import Immobilizations

Tariffs are any charges that must be made when goods or equipment are transported over national, state, or local borders. Within a supply chain, site selections are significantly impacted by tariffs. If a nation has high tariffs, businesses would either stop selling to the domestic market or build factories there to avoid paying customs. High tariffs cause a supply chain network to have more production locations, each of which has a less capacity allotted to it. Global corporations have consolidated their global production and distribution facilities as tariffs have fallen as a result of regional accords like MERCOSUR South America, NAFTA North America, and the European Union as well as the World Trade Organization. Tax incentives are reductions in tariffs or taxes that nations, states, and cities frequently offer to entice businesses to establish operations in particular locations. To attract investments in regions with less economic development, several nations adjust incentives from city to city. For many facilities, these incentives are frequently a crucial consideration when deciding where to build. BMW chose Spartanburg, South Carolina, for the location of its American production mostly because to the tax breaks that state provided.

Free trade zones are frequently established by developing nations, where duties and tariffs are eased as long as output is used primarily for export. Global businesses are strongly encouraged as a result to establish facilities in these nations in order to take advantage of their low labor costs. For instance, when a free trade zone was established in China near Guangzhou in the 1990s, a lot of multinational corporations decided to set up shop there. Many developing nations additionally offer additional tax breaks based on the labor force's access to training, meals, transportation, and other amenities. The degree of technology used in the product may also affect the tariffs. For instance, China completely abolished duties on high-tech goods in an effort to entice businesses to set up shop there and import cutting-edge equipment. Motorola established a sizable chip production facility in China to benefit from the lowered tariffs and other incentives offered to high-tech goods.

In order to promote the growth of domestic manufacturers, many nations also impose minimum standards for local content and import restrictions. These regulations encourage multinational corporations to establish local operations and use local suppliers. For instance, the Spanish business Games, which held roughly a third of the market share in 2005, was a

major supplier of wind turbines to China. China ruled in that year that wind farms had to purchase machinery using at least 70% local components. This required players like Games and GE to train local suppliers and source from them in order to get access to the Chinese market. China removed the local content restrictions in 2009. By that time, Chinese vendors had amassed a significant enough market share to obtain some of the lowest prices on the planet. Additionally, these vendors provided parts to GA mesa's Chinese rivals, who went on to become powerful international players.

Demand and Exchange Rate Risk

Exchange rate fluctuations are frequent and significantly affect any supply chain supplying international markets. A peak of 124 yen was reached by the dollar in 2007 and a low of 81 yen was reached in 2010, for instance. A company that manufactures its goods in Japan and sells them in the United States is subject to the danger of yen appreciation. While sales are obtained in dollars, production costs are incurred in yen. As a result, a rise in the value of the yen raises the cost of production in dollars, reducing the company's profits. Because the majority of their production capacity was situated in Japan, many Japanese manufacturers encountered this issue in the 1980s as the value of the yen increased. Their profits dropped as a result of the yen's strengthening, which also reduced their sales measured in yen from significant international markets. The majority of Japanese firms responded by constructing factories around the globe.

In the six years between 2002 and 2008, the dollar varied between 0.63 and 1.15 euros, falling to 0.63 euros in July 2008 [8].For European automakers like Daimler, BMW, and Porsche, which export numerous vehicles to the United States, the decline in the value of the dollar was particularly detrimental. A 1% increase in the euro was said to cost BMW and Mercedes over $75 million apiece annually. However, by June 2010, the dollar had risen to a peak of 0.83 euros. Financial products that limit or hedge against loss due to swings can be used to manage exchange-rate risks. However, effectively constructed supply chain networks present the chance to profit from changes in currency rates. Making the capacity flexible so that it may be used to supply various markets while incorporating some overcapacity into the network is an efficient approach to do this.

Due to its adaptability, the company can respond to changes in the currency rate by adjusting the supply chain's production flows in order to increase profitability.Companies must also account for variations in demand brought on by shifts in various nations' economy. For instance, in 2009, the economies of the United States and Western Europe contracted the actual GDP of the United States fell by 2.4 percent, while those of China and India had growth of more than 8 and 7 percent, respectively. Global corporations that have a presence in China and India as well as the ability to shift resources from contracting to expanding markets performed significantly better during this time than those who lacked these capabilities. Global supply chains will need to increase their local presence and flexibility to serve multiple markets in Brazil, China, and India as their economies continue to expand.

Fuel and Freight Costs

Any global supply chain's profitability are significantly impacted by changes in freight and fuel prices. For instance, the Baltic Dry Index, which tracks variations in the cost of transporting raw goods like metals, grains, and fossil fuels, reached its highest point in May at 4,187 and its lowest point in July at 1,709. In February 2009, crude oil prices were as low as roughly $31 per barrel. By December 2010, they had risen to about $90 per barrel. Even with supply chain flexibility, managing this much price variability can be challenging. The easiest way to deal with such changes is to hedge prices on commodity markets or get into suitable long-term contracts. Southwest Airline bought fuel hedges at reasonable prices and used them to offset fuel costs throughout the first ten years of the twenty-first century, which

contributed significantly to its profitability. Companies must take currency rate, demand, and freight and fuel cost fluctuations into consideration when planning supply chain networks.

Political Variables

The choice of venue is significantly influenced by the political stability of the nation under consideration. Businesses seek to establish their operations in nations with stable governments where the laws governing ownership and trade are clear. Even though political risk is difficult to measure, businesses can utilise indexes like the global political risk index (GPRI) when making investments in emerging nations. The GPRI, which is assessed by a consulting company Eurasia Group, tries to gauge a nation's resilience to shocks and crises in four areas: the government, society, security, and economy.

Issues with Infrastructure

For a facility to be located in a specific place, there must be a functional infrastructure available. Poor infrastructure raises the cost of conducting business in a particular area. Even though these places did not have the cheapest labor or land costs in the 1990s, multinational corporations chose to establish their plants in China close to Shanghai, Tianjin, or Guangzhou because of the favorable infrastructure in these areas. The availability of sites and labor, closeness to transportation hubs, rail service, proximity to airports and seaports, highway access, traffic congestion, and local utilities are important infrastructural factors to take into account while designing a network. When constructing their supply chain networks, businesses must take the strategy, size, and geography of their rivals into account. The choice of whether to site facilities close to or far from competition is a critical choice made by businesses [9]. This choice is influenced by factors including the type of competition and the availability of raw materials or labor.

Good Externalities between Entities

Hen several businesses collaborate, it results in positive externalities for all of them. Positive externalities encourage businesses to locate close to one another. For instance, because doing so improves total demand and benefits all parties, retail establishments frequently choose locations close to one another. Competing retail stores make it more convenient for customers by grouping together in a mall, where they can find all, they need without having to make many trips. As a result, more people visit the mall overall, creating demand for all of the stores there. Another instance of a positive externality is when the existence of a rival encourages the construction of useful infrastructure in a developing region. Suzuki was the first foreign automaker to establish a production facility in India. The business made a significant investment in creating a network of regional suppliers. Given India's established supplier base, Suzuki's rivals have also constructed assembly factories there because they now believe it is more cost-effective to produce automobiles domestically rather than import them [10].

CONCLUSION

The strategic process of network design in supply chain management is crucial for achieving supply chain effectiveness and efficiency. Organizations can optimism the flow of products, information, and resources by carefully planning and configuring the network of buildings, distribution centers, and transportation routes. The goal of network design is to keep expenses as low as possible while still delivering on consumer demand and service level expectations. Benefits of a well-designed network include better risk management, cost savings, improved operational efficiency, and better customer service. However, due to factors like globalization, outsourcing, e-commerce, and sustainability, network design has gotten increasingly complex.

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CHAPTER 10

AN INTRODUCTION TO DESIGNING GLOBAL SUPPLY CHAIN NETWORKS

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ABSTRACT:

A challenging and essential task for businesses operating in a globalized corporate environment is designing global supply chain networks. An overview of the main factors, issues, and techniques involved in creating international supply chain networks is given in this chapter. Networks of buildings, transportation routes, and information flows that span several nations and regions are referred to as global supply chain networks. In order to achieve operational efficiency, cost effectiveness, and customer satisfaction on a worldwide scale, the design process comprises optimizing elements including facility locations, transportation modes, inventory positioning, and information systems.

KEYWORDS:

Chain Management, Global Supply, International Supply, Management, Supply Chain.

INTRODUCTION

In the process of creating supply networks, globalization has raised risk while also providing enormous opportunities. High-performance supply chains, like those at Zara and Nokia, have fully benefited from globalization. Contrarily, a number of supply chains have discovered that they are unprepared for the elevated risk that has come along with globalization. As a result, when creating a global supply chain network, managers must take both opportunities and risks into consideration over the long term. This chapter identifies sources of risk for international supply chains, discusses risk management techniques, explains the approaches for evaluating network design choices in the face of uncertainty, and demonstrates how these techniques enhance international supply chain choices. Companies have chances to both increase revenues and cut costs because to globalization. According to P&G's 2008 annual report, developing markets accounted for more than a third of the company's sales growth and had profit margins that were on par with those of established markets.

By 2010, the company's sales in developing nations accounted for over 34% of its overall sales. Similar to this, China and India represented Nokia's two biggest international markets in 2009 in terms of net sales. In 2009, sales in these two nations accounted for about 21.5 percent of Nokia's total global sales, while sales in the BRIC nations Brazil, Russia, India, and China accounted for more than 28 percent. Undoubtedly, globalization has created considerable opportunities for revenue growth for P&G and Nokia [1], [2]. Two industries where globalization has significantly lowered costs are apparel and consumer electronics. Consumer electronics concentrates on low-volume, high-value products that are simple and economical to transport. By concentrating the manufacturing of standardized electronics components at a single facility for use in numerous products around the world, businesses have taken advantage of significant economies of scale. With facilities in low-cost nations, contract manufacturers like Falcon and Flextronics have grown into global giants. The production of clothing requires a lot of labor, yet the finished item is lightweight and relatively inexpensive to ship.

Businesses have taken advantage of globalization by moving a lot of the manufacture of clothes to nations with cheap labor, particularly China. About 33% of clothing imported into the United States in the first half of 2009 came from China. Overall, both industries have profited greatly from cost reduction brought about by globalisation. However, it is important to remember that the advantages of globalization frequently come with a considerable increase in risk. In a poll done by the consulting firm Accenture in 2006, more than 50% of the executives asked thought their global operations strategy had raised supply chain risk. For instance, storm damage to 40,000 acres of plants in 2005 reduced Dole's global production of bananas by nearly 25%. Sony's PlayStation 3 gaming console's component shortfall during launch affected sales and the company's stock price. The difference between successful and unsuccessful global supply chains has frequently been the capacity to include appropriate risk mitigation into supply chain design.

The Accenture poll asked respondents to identify the variables that affected them and categorized risk in global supply chains as illustrated in Table 6-1. Natural disasters, the fluctuation of fuel prices, and the performance of supply chain partners all had an effect on more than one-third of the respondents. 2008's changes in the spot price of crude and the value of different currencies serve as an example of the severe volatility that global supply chains must manage. Crude prices peaked in July at over $140 per barrel, fell to below $40 per barrel in December, and started the year 2008 at roughly $90 per barrel. The euro's exchange rate in 2008 fluctuated from almost $1.47 at the start of the year to almost $1.60 in July, then to approximately $1.25 at the end of October before rising once more to $1.46 by the end of December. One can only speculate on the devastation such variation caused to the efficiency of the supply chain in 2008! Since then, petroleum prices and currency rates have both fluctuated similarly.

Uncertainty appears to be the only constant in the management of the global supply chain. A corporation undergoes changes in demand, prices, exchange rates, and the competitive climate over the course of a supply chain network. A choice that seems wise in the present circumstances may turn out to be quite poor in the future. The euro moved from a low of $0.84 to a high of approximately $1.60 between 2000 and 2008. It is obvious that supply networks that were designed to operate at $0.84 per euro would struggle to function effectively at $1.60 per euro. Building flexible production capacity at a plant is valuable because of demand and price volatility.

A worldwide network's flexible manufacturing capacity can be changed to maximize profits in the new environment if price and demand do change over time. In the United States, auto sales decreased by more than 30% between 2007 and 2008. All vehicle types were impacted, but the decline in sales of SUVs was significantly greater than the decline in sales of small cars and hybrids.

While sales of SUVs decreased by about 35%, those of small cars actually went up by roughly 1%. Because its factories could produce both car types, Honda was able to manage this variation better than its rivals. With the ability to manufacture both SUVs and cars in the same location, Honda plants were able to maintain a reasonable level of utilization. Companies that built factories solely for the production of SUVs, however, were forced to leave a significant amount of capacity idle. Toyota increased the adaptability of its international assembly plants in the late 1990s so that each factory could serve numerous markets. One of the key advantages of this flexibility is that it enables Toyota to adjust output to maximize profits in response to changes in demand, exchange rates, and local prices. Therefore, while choosing a worldwide network design, supply, demand, and financial uncertainty must all be taken into account.

Off Sourcing Choice: Total Cost

When Adam Smith wrote in The Wealth of Nations, If a foreign country can supply us with a commodity cheaper than we ourselves can make it, better buy it from them with some part of the produce of our own industry, employed in a way in which we have some advantage, he was recognizing the significance of comparative advantage in global supply chains. One of the main justifications for a supply chain becoming global is often cost savings through the relocation of production to low-cost nations [3], [4]. Quantifying the advantages (or comparative advantage) of offshore manufacturing and the factors that contribute to this comparative advantage, however, is a difficulty. While many businesses have benefited from cost savings through offshore, others have discovered that these benefits are significantly less than anticipated, and in some cases nonexistent. The perceived advantages of offshore have been significantly harmed by the increases in transportation costs between 2000 and 2011. For two main reasons, companies have not benefited from outsourcing:

1. Neglecting important risk variables while making the offshoring decision.
2. Focusing solely on unit cost rather than total cost.

This section focuses on the criteria that must be considered when deciding whether to offshore production along the total landed cost axis. When offshoring, it is possible to identify the key components of total cost by concentrating on the entire sourcing procedure. It is crucial to remember that a global supply chain with outsourcing lengthens and prolongs financial, product, and information flows. As a result, managing the supply chain may be more difficult and expensive than anticipated. According to Ferreira and Prophets 2009, businesses should assess how offshoring may affect the following significant components of total cost:

1. Supplier price should be linked to prices for direct materials, direct labor, indirect labor, management, overhead, capital amortization, local taxes, manufacturing costs, and costs associated with local regulatory compliance.
2. Periods Net payment periods and any volume discounts have an impact on expenses.
3. Delivery expenses this includes packaging, in-country transit, and air/ocean freight to and from the final destination.
4. Include in-plant inventories, in-plant handling, plant warehouse expenses, supply chain inventories, and supply chain warehousing expenses.
5. The cost of quality includes the price of validation, the price of decreased performance brought on by lower quality, and the price of incremental remedies to counteract quality decline.
6. Customer responsibilities, value-added taxes, and local tax breaks
7. Risk-related expenses, broker fees, infrastructure facilities and IT, and tool and mound costs.
8. Trends in exchange rates and how they affect price.

DISCUSSION

Global supply-chain management is the process of distributing products and services throughout a network of international businesses in order to increase revenue and reduce waste. Global supply chain management is essentially the same as supply chain management, with a focus on transnational businesses and organizations. There are six key areas of focus in global supply-chain management: operations management, supply management, supply chain coordination, competition orientation, customer orientation, and logistics management. These six concentration areas can be broken down into four basic categories: supply management, operations management, marketing, and logistics. In order to successfully manage a global supply chain, one must also abide by the different rules and guidelines established by various non-governmental organizations, such as The United Nations. Several variables that impose

regulations on certain supply chain elements may have an impact on the management of global supply chains. Governmental and non-governmental organizations are essential in this area because they develop and uphold the rules and laws that businesses must follow.

The social issues such as labor, environmental, etc. that are relevant to the implementation and operation of a global supply chain are frequently governed by these regulatory policies. Companies are required to abide by the rules set forth by these regulatory laws, which frequently have an impact on a company's profitability [5]. There are many risks involved in operating and maintaining a global supply chain. The two primary kinds of these risks are supply-side risk and demand-side risk. A category known as supply-side risk covers dangers related to raw material availability that affect a company's capacity to meet client needs. Risks related to the availability of the finished product fall under the category of demand-side risk. A manager may decide to reduce or accept these risks depending on the supply chain. Implementing the right concentration framework, adhering to international laws established by governments and non-governmental organizations, and recognizing and managing the risks involved while maximizing profit and minimizing waste are all necessary for successful global supply-chain management.

Concentration Areas

Global supply chain managers should place a strong emphasis on marketing to increase customer value, satisfaction, and loyalty. Improved profit margins result from increased customer value, satisfaction, and loyalty, which in turn promotes total business growth. Managers must consider their strategies and how they will affect the entire supply chain. The customer perspective approach is one market strategy that is frequently employed by companies with international supply chains. A customer-centric approach to marketing strategy implies putting the customer first. Understanding the complexity of client values is the main objective from this viewpoint. Understanding how a client forms and develops their values is necessary for this viewpoint. Understanding how a consumer establishes their values enables a business to make adjustments that will appeal to the customer base's values and, in turn, increase profit. Managers who are attempting to develop and implement a marketing plan that most closely aligns with client values encounter four typical and significant problems.

In a global supply chain, managers must first overcome the difficulty of precisely identifying what customer’s value. The problem of determining which supply streams customers appreciate the most is the main emphasis of understanding customer values in a global supply chain. Understanding the ongoing shifts in client values along global supply chains is the second problem. It is getting more and harder to remain ahead of the curve and try to foresee shifting values since customers are continually changing what they value. Delivering values in a context that has never seen this level of marketplace presents the third challenge. Businesses are increasingly utilizing the global market, which presents the problem of attempting to provide value in a nation or region that has never been exposed to a marketplace like this. The third and last difficulty is coming up with solutions and maintaining commitment to them. Solutions to these problems have been put into place, but maintaining them is difficult, especially when firms place more focus on cost-cutting measures.

Logistics With a surge in business-to-business international marketing, it is crucial to focus on logistics performance when managing a global supply chain. A worldwide supply chain's logistics are inherently challenging and complicated because of challenges with cross-currency transactions, shipping distances, and trade laws. Companies and/or organizations who priorities logistics management may find that they have a significant competitive advantage as a result of the influence that it has on customers. When implementing and

administering a company's logistic services, a company has found that focusing on client preferences provides a number of advantages. Among the main advantages is cost savings. If the business determines all the required logistical segments and then eliminates unneeded and redundant ones, costs might be decreased. Customizing logistics not only lowers costs but also boosts sales by luring in a customer base that stays loyal to the company. Organizations must create global logistical plans that adequately and successfully address the expectations of the consumer if they want to remain competitive. By doing this, businesses can benefit from the increasingly lucrative worldwide market [6], [7].

Supply Control

Development and management of the vital business and supplier connection are topics covered by supply management. To control the movement of goods and information, several organizations utilised supply chain management software. Oracle, EPCOR, Inform, NetSuite, and IBM are notable companies that offer supply management services. The practice of outsourcing suppliers is being adopted more frequently as the industry grows increasingly worldwide. A company can gain from outsourcing suppliers in a number of ways if they can successfully manage the relationship.

The market for supply chain management was estimated to be worth $18.7 million globally in 2020 and was expected to be worth $52.6 million by 2030. Segmental focus, relevancy, reactivity, and adaptability are the skills that are associated with the competency of customer integration. The capacity to create customer-focused programmers that are especially created to achieve maximum customer success is referred to as segmentation focus. Relevancy is the capacity to uphold and adjust customer-focused strategies to take into account continuously shifting expectations.

The capacity to fulfil particular and unexpected consumer requests or requirements is referred to as responsiveness. The ability to adequately adjust to any unexpected scenario is referred to as flexibility. The fundamental competencies linked to the internal integration competency are cross-functional unification, standardization, simplicity, and compliance. The ability to convert potential cooperative actions into controllable operational processes is referred to as cross-functional unification. The ability to implement procedures and/or policies that address any concurrent operations is referred to as standardization. The ability to recognize, accept, use, and improve the finest business practices is referred to as simplification. The ability to adhere to any established policies is referred to as compliance. Strategic alignment, operational fusion, financial linkage, and supplier management are the skills associated to material/service supplier integration. Strategic alignment is described as the capacity to create a corporate culture or shared vision that generate a shared responsibility. Operational fusion is the process of joining systems to lessen redundancy.

The ability to collaborate financially with suppliers to accomplish shared objectives is referred to as financial connection. The ability to expand management to incorporate the hierarchical structure of suppliers is referred to as supplier management. The skills that are covered by technology and planning integration include information management, internal communication, networking, and collaborative forecasting and planning. Information management refers to the capacity to allocate resources along the full chain via seamless transactions. Internal communication is the skill of effectively communicating within a company. Connectivity is the capacity for information and communication exchange between a company and an external supply chain partner. To identify and create shared visions with clients, one must be capable of collaborative forecasting and planning. Functional assessment, thorough metrics, and financial impact are the abilities that support measurement integration. The term functional assessment describes the capacity to create and use a suitable performance measuring tool.

The ability to implement cross-business performance criteria is referred to as comprehensive metrics. Financial impact describes the relationship between the outcomes of the financial measurement and the general performance of the supply chain. Role specificity, guidelines, information sharing, and gain sharing are the abilities that support relationship integration. The capacity to precisely define leadership and construct a set of shared and individual tasks is referred to as role specificity. The ability to develop and apply regulations and norms that control everyday encounters is referred to as having guidelines. The readiness to communicate crucial information often including financial, technical, or strategic information across the supply chain is referred to as information sharing. Gain/risk sharing refers to how incentives and penalties are fairly divided and distributed. Managers can recognize and put into practice the six business competencies' six underlying capabilities by using the 21st-century logistics framework [8]. The framework allows managers the opportunity to choose whatever skills they think are most crucial to implementing in order to successfully manage a global supply chain.

Theory of Human Collaboration

According to the human cooperation theory, investments in supply-chain management have the biggest effects when they concentrate on fostering collaboration inside the supply chain. This management theory is concerned with the manager's capacity to support and foster employee collaboration across the whole global supply chain. Human cooperation is the utilization of abilities through coordination of individuals, teams, and organizations to accomplish goals that are bigger than what can be accomplished by a single person. The framework for human collaboration identifies four essential elements. The first component focuses on the forces that drive change, the second on the people, technology, and process assets that foster network collaboration, the third on the opposing forces that persuade people to oppose collaboration, and the fourth on the desired performance of collaboration. According to the theory, a manager needs to comprehend and utilised these elements in order to implement and run a successful global supply chain.

According to the theory, in order to implement and run the best collaboration system, a manager must foster trust among the chain's various participants supplier and manufacturer, create a culture that encourages decision-making and work, put in place a suitable reward system, and engage in synergistic activities. The theory's authors propose four measures that a management must take in order to make their network more collaborative. Recognizing that the company will need innovations that can be suggested by people outside the corporate border is the first step. As a result, in order to access these people, the firm needs to increase its collaboration with external partners. By acknowledging the many types of collaboration transactional, co-operative, coordinated, and synchronized, they must then modify their perspectives on how to achieve collaboration. A manager must then create a team plan to accomplish the objectives they have set. Finally, a manager must create the proper controls to guarantee that the objectives or purpose can be achieved. Managers who design a suitable global supply chain that emphasizes human collaboration and abides by the suggestions given by this theory will produce better results.

Regulations from Abroad

Governments can have a significant impact on how certain components of global supply chains are regulated. Regulations can be implemented by governments through a variety of policy instruments. Taxation, financial incentives, regulation, liberalization, infrastructure, land use planning, guidance, and exhortation are just a few of the tools that can be used. However, it is crucial for governments to properly analyze any potential second-order impacts before developing and putting into practice a legislation. Second order impacts are the compensating effects that arise in other areas as a result of the application of a policy.

Governments have been steadily introducing legislation to support green supply chains in recent years. The relevant government must consider the five components of sustainable logistics while designing and implementing.

The first is lowering the intensity of goods mobility, as governments are increasingly need to implement explicit laws to encourage businesses to lower the quantity of goods movement inside their systems. The author refers to the second factor as the transfer of freight to more environmentally friendly modes of transportation. This can be promoted by governments via policy tools often taxation, financial incentives, regulation, and infrastructure improvements. The third factor is vehicle utilization, which requires governments to work to encourage businesses to increase their use of road freight.

Taxation, regulation, liberalization, and advisory panels can all be used to achieve this. Increased energy efficiency is the fourth factor, which is frequently observed with the adoption of general efficiency programmers. To encourage a better standard of energy efficiency, governments can increase fuel taxes, fund driver training programmers, lower and enforce speed restrictions, impose fuel economy standards, encourage the scrapping of outdated cars, and offer guidance. The fifth and final factor is reducing emissions in relation to energy use, which requires a policy.

The United Nations' Function

The creation and implementation of international laws, which have a significant impact on the administration and functioning of global supply chains, is mostly the responsibility of the United Nations. The UN worldwide Compact was established by the UN with the purpose of igniting a worldwide movement of stakeholders and businesses committed to sustainability.

The UN worldwide Compact supports businesses in being responsible and advancing societal goals in an effort to spark a worldwide movement. The group has developed a list of ten principles that they demand businesses follow. The four overarching areas of human rights, labor, the environment, and anti-corruption encompass the ten principles.

In terms of human rights, the organization urges companies to uphold, respect, and ensure that they are not violating any existing human rights regulations. The acknowledgment of collective bargaining, prohibition of child work, abolition of forced employment, and elimination of discrimination are all covered by the labor principles. The environmental tenets include being aware of environmental risks, supporting more environmental accountability, and fostering the advancement of ecologically beneficial technologies [9]. According to the anti-corruption principle, corporations should combat corruption. They have released two manuals that show how companies may integrate sustainability into their supply chains and use the ten principles. According to these manuals, organizations can successfully become sustainable by taking particular actions, such as committing, defining, implementing, evaluating, measuring, and communicating [10].

CONCLUSION

Designing international supply chain networks is a crucial task for businesses working in the linked and globalized business environment of today. In order to maximize operational efficiency, economic effectiveness, and customer satisfaction on a worldwide scale, this procedure entails optimizing facility locations, transportation routes, and information flows. In addition to navigating trade restrictions, cultural variations, differing infrastructural capacities, and managing supply chain risks across numerous areas, developing global supply chain networks presents major hurdles. Organizations can, however, overcome these difficulties by implementing tactics including regional distribution hubs, multimodal transportation choices, technological advancements, and partnerships with regional partners.

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CHAPTER 11

A BRIEF OVERVIEW: RISK MANAGEMENT IN GLOBAL SUPPLY CHAIN

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ABSTRACT:
The identification, assessment, and mitigation of risks that may affect the flow of goods, information, and resources across international borders is a crucial component of supply chain management. The idea of risk management in international supply chains and the practice of supply chain risk management are both outlined in this chapter. Global supply chains are vulnerable to a number of hazards, such as geopolitical unpredictability, natural disasters, disruptions in suppliers, delays in transit, and regulatory changes. These hazards have a severe negative effect on business continuity, can result in losses, and can harm people's reputations.

KEYWORDS:

Chain Risk, Decision Tree, Global Supply, Risk Management, Supply Chain.

INTRODUCTION

Supply chain risk management SCRM is defined as the application of strategies to manage both routine and extraordinary risks along the supply chain based on continuous risk assessment with the objective of reducing vulnerability and ensuring continuity. After consulting with risk management services, SCRM employs risk management process tools, either independently or in partnership with supply chain partners, to address risks and uncertainties relating to logistics-related activities, product availability goods and services, or resources in the supply chain. Through a coordinated, all-encompassing strategy that ideally involves all supply chain stakeholders, SCRM aims to lessen supply chain vulnerability by detecting, assessing, and addressing potential failure points or modes that could exist within or have an impact on the supply chain. The supply chain is at risk from everything from unforeseen natural disasters such tsunamis and pandemics to fake goods, which affect product quality, security, resilience, and integrity.

Logistics, cybersecurity, finance, and risk management practices can all be used to reduce supply chain risks. The ultimate objective is to ensure supply chain continuity in the case of situations or disasters that would otherwise have disrupted regular business operations and, in turn, profitability. Since resilience and other precautions raise production costs even when everything goes according to plan, they must be cost-effective. There are logistics risk management programmers, which comprise defensive driving trainings, fleet audits, cargo loss minimization, road safety, warehouse safety, etc., to prevent supply chain management interruptions [1]. Lean manufacturing and supply-chain optimization are two strategies in supply chain logistics that can harm continuity and resilience. Businesses, especially manufacturers, are increasingly implementing supplier quality management practices throughout their supply chains. This strategy has been demonstrated to promote transparency, cut administrative expenses, and boost operational effectiveness.

Disruption to the Supply Chain's Length

Over 559 businesses from 65 different countries participated in the Business Continuity Institute BCI and Zurich survey in 2011, and the results showed that over 85% of businesses

had at least one supply chain disruption that year. This number has decreased slightly over time, according to BCI surveys 70% in 2016 compared to 74% in 2015. In addition, 40% of the reported disruptions were attributed to sub-contractors rather than prime contractors or first-tier suppliers, according to the 2011 survey respondents. According to the 2016 survey, 22% of enterprises had 11 or more disruptions, and one in three organizations had cumulative losses of over €1 million annually as a result of supply chain disruptions.

Resilience

Identification, evaluation, treatment, risk reporting and communication, and monitoring of supply chain hazards are the four processes that commonly make up supply chain risk management. Nevertheless, given the complexity of many supply chains, these procedures might not be adequate to guarantee that all contingencies are covered. In order to ensure that the supply chain can handle incidents and recover from them regardless of their source or character, the cause-oriented notion of supply chain risk management is frequently paired with the idea of supply chain resilience. The capacity of a supply chain to persist, adapt, or transform in the face of change is how supply chain resilience is defined. According to some theories, supply networks' sustainability and resilience will be greatly enhanced by technological advancements that modernize management techniques along the entire chain, including digitalization, artificial intelligence, big data, and robotics. The Supply Chain Risk Leadership Council accepted Time to recover (TTR), a useful indicator originally developed by Cisco and measured in weeks [2]. TTR gauges how long it takes a business to resume normal operations after a significant supply chain disruption. The calculation of TTR makes the assumption that a facility is practically rendered useless as a result of a significant event, necessitating considerable repairs and reconstruction, as well as the re-sourcing and re-qualification of important equipment used in manufacturing and other processes.

Calculating Risk

The chance and impact of an event's occurrence determine supply chain risk. Although this is the most widely used method for quantifying risk, it has a disadvantage when applied to supply-chain risk because it necessitates evaluating the likelihood or probability of numerous different event types across numerous supply-chain organizations and locations possibly hundreds of thousands for, for example, a major vehicle manufacturer. Thus, the variety of options is enormous, which is annoying and restricts the kind of research that can actually be done. The methodology might be suitable for a more limited range of areas or risk kinds or categories. The majority of businesses rely on risk scores of several kinds, including the financial risk score, operational risk score, and resiliency score R Score. These are easily accessible, reasonably easy to comprehend and analyze, and can therefore be effective at least for the initial identification of concerns deserving of further examination. The baseline can be raised to a known level using standards and certified conformance like ISO 9001.

DISCUSSION

Today's global supply chains are more vulnerable to risk factors than earlier localized supply systems. These hazards include supply interruption, supply delays, fluctuating demand, fluctuating prices, and fluctuating exchange rates. Underestimating risks in global supply chains and failing to put effective mitigation methods in place can have devastating consequences, as was demonstrated by the financial crisis of 2008. For instance, during the start of the 2004 flu season, a serious shortage was caused by contamination at one of the two suppliers of flu vaccine to the United States. In most places, this shortage resulted in rationing, and in some, it led to extreme price gouging. Similar to this, enterprises with a large portion of their supply sources in Western Europe suffered from the euro's substantial strengthening in 2008. In another case, a lack of sufficient inventory to offset supply

volatility led to high costs rather than savings. A maker of automobile components intended to save $4 to $5 million annually by sourcing from Asia rather than Mexico.

The company did not have enough inventory to address the delays due to the Los Angeles-Long Beach port congestion, so it had to hire an aero plane to fly the parts in from Asia. The corporation was forced to pay $750,000 for a charter that would have cost $20,000 per aircraft from Mexico. The savings that were projected resulted in a $20 million loss. Global supply networks must therefore be aware of the pertinent risk elements and incorporate effective mitigation techniques. A classification of supply chain hazards and their drivers that must be taken into account during network design can be found. The reduction of supply chain risk can be significantly aided by effective network design. For instance, having several suppliers reduces the chance that one single source would cause a disruption. An outstanding illustration is the different effects that the March 2000 fire at a Royal Philips Electronics facility in Albuquerque, New Mexico, had on Nokia and Ericsson.

Nokia swiftly used a number of different supply plants in its network to adapt to the outage. Ericsson, on the other hand, lacked a backup supply in its network and was powerless to respond. According to Ericsson, this resulted in a $400 million revenue loss. Similar to this, having flexible capacity reduces the risks associated with changes in exchange rates, prices, and demand around the world. As an illustration, Hino Trucks use flexible capacity at its facilities to adjust production volumes for various products by moving workers between lines. As a result, despite the fact that production at each line varies to best match supply and demand, the corporation maintains a continuous workforce in the manufacturing facility. These examples show how incorporating mitigation methods within the network greatly enhances a supply chain's capacity to manage risk. But every mitigation measure has a cost and can make other hazards worse.

As an illustration, increasing inventory lowers the risk of delays while raising the danger of obsolescence. Purchasing several suppliers reduces the risk of disruption but raises costs because it may be challenging for each provider to achieve economies of scale. Therefore, it's critical to create customized risk mitigation plans during network design that strike a suitable balance between the reduction in risk and the cost increase. Lists a few customized mitigating tactics. Later in the book, the majority of these techniques are covered in more detail [3]. Global supply chains should often combine financial strategies with risk-mitigation measures built into the supply chain to address undisclosed risks. Global production may be concentrated in a few low-cost nations under a global supply chain strategy that prioritizes efficiency and low cost. A supply chain built in this way is susceptible to exchange rate and transportation price variations, as well as the danger of supply disruption. Since the supply chain design itself does not have any built-in methods to deal with these swings, it is imperative that the company hedge fuel prices and exchange rates in such a situation.

A global supply chain, on the other hand, enables production to be moved to whichever region is most effective under a certain set of macroeconomic circumstances. Financial hedges are less necessary due to the flexible design's capacity to respond to changes. Although operational hedges, like flexibility, are more difficult to implement than financial hedges, they have the advantage of being reactive because the supply chain may be adjusted to respond to the global macroeconomic environment. Any risk reduction plan is not always in the money, and this should be kept in mind. For instance, Honda facilities' flexibility only worked in 2008 when the demand for cars altered in an unpredictably unanticipated way. The flexibility would not have been used if there had been no variation in demand. Because the automotive markets were in a relatively stable position at the time, flexibility in the form of the intelligent body assembly system (IBAS) created by Nissan in the early 1990s almost put the company out of business. Similar to this, Southwest Airlines lost money near the end of 2008 as a result of the use of fuel hedges that had made the airline billions. Therefore, before

they are put into practice, risk mitigation measures must undergo a thorough assessment of their predicted long-term worth as genuine possibilities. The approaches that enable the financial evaluation of risk mitigation strategies built into a global supply chain are covered in the sections that follow.

Chaining, Flexibility, and Containment

A global supply chain faces a variety of risks and uncertainties, and flexibility is crucial in reducing those risks and uncertainties. New product flexibility, mix flexibility, and volume flexibility are the three broad categories into which flexibility can be classified. The ability of a company to quickly launch new items onto the market is referred to as new product flexibility. In a competitive market where technology is changing and consumer demand is erratic, new product adaptability is essential. The ability to provide a variety of distinct models with a minimal number of unique platforms may emerge from the usage of common architectures and product platforms in new products. This strategy has historically been used by the PC industry to launch a steady stream of new devices. If a portion of the production capacity is adaptable enough to make any product, new product flexibility may also develop. This strategy has been applied in the pharmaceutical sector, where a small portion of the capacity is particularly flexible and where all new medicines are initially produced. The product is not relocated to a specialized facility with fewer variable costs until after it becomes successful [3], [4].

Mix Flexibility: It is the capacity to generate a range of goods in a little amount of time. In a situation where demand for particular products is low or extremely unpredictable, the supply of raw materials is unclear, and technology is developing quickly, mix flexibility is essential. An excellent example of where mix flexibility is crucial in production environments is the consumer electronics sector, particularly since more production has shifted to contract manufacturers. Zara's European facilities have great mix flexibility with to modular design and shared components, enabling the company to supply contemporary clothing with much unexpected demand. The ability of a company to generate profits at various output levels is referred to as volume flexibility.

Volume Flexibility: It is essential in sectors with cyclical demand. When demand for autos in the United States fell sharply in 2008, it severely harmed automotive companies that had volume flexibility. One sector where some volume flexibility and consolidation have aided performance is the steel industry. Prior to 2000, businesses did not change production quantities when demand started to decline because they had no volume flexibility. As a result, inventories increased and the price of steel significantly decreased. Several significant companies combined at the beginning of the 2000s and improved their volume flexibility. They were able to reduce production as demand decreased as a result. As a result, the steel industry has experienced a quicker recovery and a reduction in inventory buildup during downturns. It is crucial to comprehend the advantages and constraints of this strategy because it is frequently employed to reduce risks in international supply chains. Jordan and Graves 1995 make the crucial discovery that as flexibility increases, the marginal advantage from the increase in flexibility diminishes when coping with demand uncertainty.

They recommend making this concept operational in the chaining concept, which is demonstrated in the example below. Think of a business that sells four different products. As a dedicated supply network with no flexibility would consist of four factories, each producing a single product. Each plant would be able to produce each of the four products in a completely flexible network arrangement. When demand for each of the four goods is erratic, plants' flexibility in output is advantageous. The company is unable to meet demand that exceeds plant capacity even with dedicated plants. The company can move surplus demand for a product to a facility with excess capacity thanks to flexible plants. A chained network

defined by Jordan and Graves has one long chain limited flexibility and is set up as depicted. Each plant in a chained arrangement has the flexibility to produce two products, with the plants and their products arranged in a chain. A linked network reduces the risk of demand volatility almost as effectively as a completely flexible network, according to Jordan and Graves. The findings of Jordan and Graves suggest that chaining is a great way to reduce costs while still obtaining the majority of the advantages of flexibility given the greater cost of full flexibility.

When developing chained networks, it's crucial to consider the intended chain length. Longer chains provide the benefit of more efficiently pooling available capacity when dealing with demand uncertainty. Long chains do, however, have some drawbacks. A single lengthy chain may have a larger fixed cost than a number of shorter chains. A single lengthy chain makes coordination across the network more challenging because every fluctuation has an impact on every facility in the chain. Several academics have also noted that flexibility and chaining work well when coping with demand fluctuations but less well when handling supply disruptions. Lim et al. found that building smaller chains that contain or restrict the impact of a disruption can be more successful than designing a network with one long chain when there is a supply disruption. Any interruption to one of the chains has no effect on the other chain under this configuration. Hog farming is a straightforward illustration of containment: The hogs are maintained isolated in small groups to guarantee that the danger of disease is limited within a group and does not spread to the entire farm, despite the fact that the farms are huge to benefit from economies of scale [5].

Reduced Cash Flows

Decisions on the architecture of global supply chains should be assessed as a series of cash flows over the course of their implementation. In order to do this, future cash flow projections must take into account risks and uncertainties that could occur in the global supply chain. The present value of a stream of cash flows is what that stream is worth in today's dollars. In this section, we cover the fundamentals of analysis to assess future cash flows before incorporating uncertainty in the next section. By determining the present value of any stream of future cash flows, discounted cash flow analysis enables management to compare two streams of future cash flows in terms of their financial worth. Because a dollar today may be invested and generate a return in addition to the original investment, DCF analysis is founded on the fundamental tenet that a dollar today is worth more than a dollar tomorrow. The fundamental method for evaluating the relative worth of upcoming cash flows that will come at various points in the future is provided by this assumption.

Using Decision Trees to Evaluate Network Design Decisions

Demand, prices, exchange rates, and a number of other elements are highly speculative and are likely to vary over the course of any supply chain decision. The issue with applying a straightforward DCF analysis in an unpredictable setting is that it frequently undervalues flexibility. The end result is frequently a supply chain that functions perfectly when everything goes as expected but becomes extremely costly when something unexpected occurs. When creating a supply chain network, a manager must make a number of choices.

1. For instance, should the business lease warehouse space on a long-term basis or purchase it on the spot market as needed?
2. What should the company's portfolio of transport capacity's mix of long-term and spot market be?
3. What capacity range should different facilities have? How much of this capacity ought to be flexible?

A manager will always sign long-term contracts because they are normally less expensive and steer clear of any flexible capacity since it is more expensive, if uncertainty is ignored. However, if future demand or price expectations are off when the choice is made, it may damage the company. Although dedicated capacity was less expensive than flexible capacity, it could only be used for the medicine for which it was intended. Pharmaceutical firms, however, reported difficulty predicting both the market's demand and drug prices. Therefore, if the anticipated demand did not materialize, a large portion of the designated capacity might remain idle. Pharmaceutical businesses now employ the idea of maintaining a portfolio of committed and adaptable capacity. When a sufficiently precise projection of future demand is provided, the majority of products are only relocated to a dedicated facility. Managers must therefore have a technique for network design that enables them to calculate the uncertainty in their demand and pricing forecasts and then factor this uncertainty into their decision-making. Given how difficult it is to change network design decisions in the short term, this methodology is particularly crucial for these judgments. We explain such a methodology in this section and demonstrate how accounting for uncertainty can significantly affect the value of network design decisions.

Decision Tree Analysis

A decision tree is a visual tool for assessing choices when there is uncertainty. Given volatility in prices, demand, currency rates, and inflation, supply chain design decisions can be evaluated using decision trees with DCFs. Choosing the number of future time periods that will be taken into account while making the decision is the first stage in putting up a decision tree. The decision-maker must also specify how long a period will last, which could be a day, a month, a quarter, or any other period of time. The length of a period should be as least as long as it takes for factors influencing supply chain decisions to alter significantly. Although the term significant is difficult to define, it is usually reasonable to consider the length of time that an aggregate plan is in effect as the measurement of significance. We specify the length of a period to be one month if planning is done on a monthly basis.

T is the number of time intervals over which the supply chain choice is to be assessed in the discussion that follows. Finding elements that will influence the decision's value and are likely to change during the following T periods is the next phase. These variables include, among others, demand, price, exchange rate, and inflation. After determining the important variables, the next step is to determine the probability distributions that characterize each variable's variation across time. The probability of changing from a specific value of demand and price in one period to any other value of demand and price in the following period must be determined, for example, if demand and price are identified as the two main elements influencing the decision. The following step is to choose a periodic discount rate k that will be used to discount future cash flows. The same discount rate need not be applied to every period or even to each node within a period. The investment's inherent risk should be considered when determining the discount rate. Generally speaking, riskier investments should be subject to a greater discount rate. A decision tree that includes the present and T future eras is now used to analyze the decision.

For each potential pairing of factor values such demand and price that can be realized throughout a time, a node must be defined. Arrows are drawn from Period I origin nodes to Period I end nodes. The likelihood of moving from the origin node in Period in to the end node in Period in 1 is known as the transition probability and is represented by the probability on an arrow. Beginning with nodes in Period T and moving back to Period 0, the decision tree is assessed. The decision is optimized for each node while taking into account both the present and potential future values of numerous parameters. Bellman's principle, which asserts that for any choice of strategy in a given state, the best strategy in the following period is the one that is chosen if the entire analysis is supposed to begin in the next period, is the

foundation of the analysis. Due to this principle, the optimal approach can be solved backwards, beginning with the most recent period. Future cash flows are discounted back and taken into account in the decision that is being thought about right now [5]–[7]. Amount of the investment value and the choices made for each period are provided by the node in Period 0. Spreadsheets can be used to solve decision trees using tools like Tree plan. Here is a summary of the decision tree analysis methodology:

1. Determine the number T of periods across which the decision is to be reviewed, as well as the length of each period month, quarter, etc.
2. List the variables, such as demand, price, and exchange rate, whose variation will be taken into account throughout the following T periods.
3. Choose the appropriate distribution to model the uncertainty by identifying representations of uncertainty for each factor.
4. Determine the k-factor for each period's periodic discount rate.
5. Display the decision tree with specified states for each period as well as the probability of transition between states over time.
6. Working backwards from period T to period 0, determine the best course of action and the anticipated cash flows at each stage. When factored into the prior period, anticipated cash flows at each state for a given period should be discounted back.

At Trips Logistics, flexibility is being evaluated

We use the leasing decision the general manager of Trips Logistics must make to demonstrate the decision tree analysis process. The manager must choose how much warehouse space to lease and whether to lease it for the next three years. Right now, the long-term lease for warehouse space is less expensive than the going rate.

Over the next three years, the management foresees fluctuating demand and spot prices for warehouse space. Although the long-term lease is less expensive, it might not be used if demand is less than expected. In the event that future spot market values decline, the long-term lease may also turn out to be more expensive. In contrast, spot market rates are high, and if future demand is high, warehouse space from the spot market will be pricey [8]. The manager is weighing three possibilities:

1. Purchase all necessary warehouse space on the spot market.
2. Sign a three-year lease for a specific amount of warehouse space and get the spot market's additional criteria.
3. Sign a flexible lease with a low monthly fee that permits variable warehouse space usage up to a predetermined maximum with additional spot market requirements [9].

CONCLUSION

The practice of supply chain risk management and risk management in global supply chains are essential elements of effective supply chain management. Effective risk management techniques are essential given the complexity of global supply chains and the risks brought on by geopolitical, environmental, and operational issues. Organizations can detect, evaluate, and reduce risks that could obstruct the flow of resources, information, and goods across international borders by putting risk management practices in place. Organizations can foresee potential interruptions thanks to this proactive strategy, which also enables them to create backup plans and put stronger supply chain resilience into action.

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CHAPTER 12

DEMAND FORECASTING IN THE SUPPLY CHAIN: ANTICIPATING MARKET NEEDS

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ABSTRACT:

Supply chain management's crucial demand forecasting method involves predicting future consumer demand for goods and services. An overview of the idea of demand forecasting and its importance in supply chain operations is given in this chapter. For businesses to efficiently schedule production, acquisition, inventory management, and distribution tasks, accurate demand forecasting is crucial. Organizations may optimism their supply chain operations, cut costs, raise customer service standards, and eliminate stock outs or surplus inventory by understanding future demand patterns. Demand forecasting is the practice of estimating the volume of goods and services that consumers will demand at some point in the future.

KEYWORDS:

Demand Forecasting, Demand Planning, Forecasting Technique, Forecasting Error, Lead Time.

INTRODUCTION

In order to estimate customer demand while taking important economic variables into account, demand forecasting techniques more particularly involve applying predictive analytics. Through effective supply chain management, this is a crucial instrument for maximizing firm profitability. The two main categories of demand forecasting techniques are qualitative and quantitative techniques. The foundation of qualitative approaches is information acquired from the field and expert opinion. When there is little data available for analysis, such as when a company or product has just entered the market, this strategy is frequently used. However, quantitative techniques make predictions using available data and analytical tools. Demand forecasting can be used to allocate resources, manage inventories, determine future capacity needs, and decide whether to join a new market.

Demand forecasting is crucial for companies across a range of industries, especially when it comes to reducing the risks connected to specific company operations. However, because of the complexity of analysis, particularly quantitative analysis, demand forecasting is regarded to be a difficult process for firms. However, any industry must have a thorough awareness of client wants in order to perform company activities effectively and more effectively meet consumer needs. Businesses can gain a number of advantages if they can predict demand accurately. These could lead to significant gains in sales and revenue, as well as waste reduction and resource allocation that is optimized [1]. Expanding on the aforementioned, a few factors that make demand forecasting necessary for firms include:

Goal-Achieving: The majority of successful organizations will have long-term strategies and predetermined growth trajectories to make sure the business is working at its optimal output. Businesses can be proactive in ensuring that objectives will be achieved in this competitive climate by having a grasp of future demand markets.

Business Decisions: With regard to achieving objectives, managers and important board members can make tactical business decisions that support greater profitability and growth by

having a complete understanding of future industry demand. The principles of capacity, market targeting, raw material acquisition, and understanding vendor contract orientation are typically connected to these choices.

Growth: Businesses can assess the need for expansion within a timeframe that enables them to do so affordably by having a thorough understanding of future forecasts.

Human Capital Management: If an industry experiences a sudden rise in demand, but a company lacks the staff to fill orders, customer loyalty may suffer as customers are compelled to shop at rival businesses.

Financial Planning: It is essential to comprehend demand projections in order to effectively budget for upcoming operations with respect to elements like cash flow, inventory accounting, and general operating expenses. Since less safety stock needs to be kept, using an accurate demand forecasting model can significantly reduce a company's operational expenditures.

Applications

Numerous sectors where projections of the future need use of future conditions can benefit from forecasting. The degree of accuracy varies greatly per field. It is likely that the final value will be close to the forecast if the factors that connect to what is being predicted are well known and understood and there is a sizable amount of data that can be utilised. The projections' reliability may be much lower if this is not the case or if they have an impact on the final result. Again, forecasting for buildings has become more popular as a result of rising energy costs and climate change. This makes an effort to lower the amount of energy required to heat the building, hence lowering greenhouse gas emissions. For manufacturing and distribution businesses, forecasting is used to plan for consumer demand. Although the efficient-market theory is used to challenge the accuracy of projections for real stock returns, predicting for broad economic trends is a widespread practice.

Both nonprofit organizations and for-profit private institutions offer this type of study. Chart and fundamental analysis are frequently used to predict changes in foreign exchange rates. Chartists investigate simply the price activity of a market, but fundamentalists try to find the causes of the action. This is a key distinction between chart analysis and fundamental economic analysis. To make a final prognosis on the currency under consideration, financial organizations combine the data from their fundamental and chartist experts into one report. Conflict situation development has also been predicted via forecasting. Forecasters conduct studies that evaluate the efficacy of specific forecasting models using empirical data.

However, studies have shown that there is little variation in the precision of predictions made by those with more and less awareness about the conflict scenario. Similar to this, specialists in certain research contend that role thinking, or putting oneself in another person's shoes to predict their decisions, does not improve the forecast's accuracy [2]. The link between planning and forecasting is a significant, albeit frequently disregarded, part of forecasting. Planning anticipates what the future should look like, as opposed to forecasting, which can be regarded as predicting what the future will look like. There is no one forecasting technique that is always the best. Your objectives and your circumstances data, etc. should be taken into consideration while choosing a method. A selection tree is a nice place to look for a method. Here is an illustration of a selection tree.

DISCUSSION

The foundation of any supply chain planning is demand projections. Think about the push-pull supply chain model. In the supply chain, all push activities are carried out in advance of consumer demand, and all pull processes are carried out in response to that demand. The

degree of activity, whether it be for production, transportation, or any other scheduled activity, must be planned for push processes. The level of capacity and inventory that are available for pull procedures must be planned, but not the precise number of operations that will be carried out. In both situations, the first thing a manager needs to do is project what the level of client demand will be. Rather than performing the final mixing of the paint in response to customer orders, a Home Depot shop that sells paint orders the base paint and dyes in advance of those orders. Home Depot employs a push approach to decide how much paint and dye to stock up on based on a projection of future demand.

Forecasts are required further up the supply chain by the paint facility that creates the base in order to decide on its own production and inventory levels. For the same reason, the suppliers to the paint manufacturer want forecasts. These forecasts are frequently significantly different when each level of the supply chain creates its own independent forecast. A mismatch between supply and demand arises as a result. It is usually significantly more precise when a supply chain's many stages collaborate to create a prediction. Supply chains can serve their consumers more effectively and quickly as a result of the prediction accuracy. By embracing collaborative forecasting, leaders in numerous supply chains, from PC makers to merchants of packaged goods, have enhanced their capacity to balance supply and demand [3], [4]. If you think of Coca-Cola and its bottlers, you can see the value of collaborative forecasting.

Coca-Cola bases its timing decisions for various promotions on the demand projections for the upcoming quarter. A revised demand prediction is then updated with promotion decisions. For the bottlers to plan their capacity and production decisions, the updated forecast is crucial. Profits in the supply chain are harmed since a bottler operating without an updated projection based on the offer is unlikely to have enough supply available for Coca-Cola. The easiest products to forecast are typically those with mature markets and consistent demand, such milk or chapter towels. When the availability of raw materials or the demand for the finished product is highly erratic, forecasting and the ensuing managerial decisions are quite challenging. Several high-tech products as well as fashion goods are examples of items that are challenging to foresee. In both situations, a forecast error estimate is crucial for supply chain design and reaction planning. We briefly list the qualities of predictions that a manager must comprehend in order to construct and operate his or her supply chain efficiently before we get into an in-depth discussion of the forecasting methods and components in the supply chain.

Forecast Characteristics

The following forecasting traits should be understood by businesses and supply chain management. Because forecasts are inherently unreliable, they should provide both the expected value of the projection and a calculation of the forecast error. Consider two vehicle salesmen to see the significance of forecast mistake. One of them anticipates sales to range from 100 to 1,900 units, while the other anticipates sales to be in the 900–1,100-unit range. Both dealers expect 1,000 in average sales, but given the disparity in forecast accuracy, each dealer's sourcing practices should be rather different. Therefore, a fundamental factor in the majority of supply chain decisions must be the forecast error or demand uncertainty. Unfortunately, the majority of businesses don't keep track of forecast error estimates.

Long-term forecasts often have a higher standard deviation of error relative to the mean than short-term forecasts, which means that long-term forecasts are less accurate on average than short-term forecasts. This crucial characteristic has been utilised by Seven-Eleven Japan to enhance performance. The business established a replenishment procedure that enables it to fulfil an order within a few hours. For instance, if a store manager puts an order at 10 AM, it will be delivered by 7 PM same day. Therefore, with fewer than 12 hours till the real sale, the manager simply needs to predict what will sell that evening. Due to the short lead time, a

manager is able to consider recent facts that may have an impact on product sales, such as the weather. If the store manager had to predict demand a week in ahead, this projection is probably more precise.

Because aggregate forecasts typically have a smaller standard deviation of error relative to the mean than disaggregate projections, they are typically more accurate. For instance, it is simple to predict the United States' gross domestic product for a particular year with an error rate of under 2 percent. However, it is significantly more challenging to predict annual revenue for a business with an error of less than 2%, and it is even more challenging to predict sales for a specific product with the same level of precision. The level of aggregate is where the three forecasts diverge most. The earnings of a corporation are an aggregate over several product lines, just as the GDP is an accumulation across many enterprises. The forecast becomes more precise as the aggregate increases. In general, the amount of information a company receives that is distorted increases the further up the supply chain it is or the further away from the consumer it is. The bullwhip effect, where order variation is exacerbated as orders travel further from the final consumer, is a well-known illustration of this. As a result, the forecast error increases as an organization moves further up the supply chain. Upstream businesses can decrease prediction inaccuracy by using collaborative forecasting based on sales to the final consumer.

Forecasting Methods and Forecasting Components

Predictions are typically tough, especially concerning the future, according to Yogi Berra, the legendary former New York Yankees catcher known for his gaffes. One would be tempted to approach demand forecasting as if it were a magical or artistic endeavor, and toss everything to chance. However, a company can predict a customer's future behavior based on what it knows about their prior behavior. Demand doesn't come about by itself. Instead, if a business can identify the connections between these characteristics and future demand, it may forecast client demand, at least with some degree of accuracy. Companies must first recognize the elements influencing future demand and then establish the relationship between these factors and demand in order to forecast demand. When predicting demand, businesses must strike a balance between objective and subjective criteria. Although we concentrate on quantitative forecasting techniques in this chapter, businesses still need to incorporate human input into their final projection. Japan's Seven-Eleven serves as an example of this.

Modern decision support tools that estimate demand and suggest an order are made available to store managers by Seven-Eleven Japan [5]. The shop manager is in charge of making the final choice and placing the purchase, though, as he or she can have knowledge of market circumstances that are not included in historical demand statistics. This understanding of the market environment will probably help the forecast. Even though demand for ice cream was high during the previous few days when the weather was hot, a store manager could lower the size of an order to be placed with an upstream supplier if they knew the weather was expected to be rainy and cold the next day. In this case, historical demand data could not have been used to forecast a change in market circumstances the weather. By enhancing its demand forecasting with qualitative human inputs, a supply chain can reap significant benefits. Numerous elements that are connected to the demand projection must be understood by a corporation, including the following:

1. Earlier demand.
2. Lead time for product restocking, planned advertising or marketing initiatives, and planned price reductions.
3. Economic situation.
4. The actions that rivals have taken.

Before choosing an acceptable forecasting process, a corporation must comprehend these considerations. For instance, traditionally, demand for chicken noodle soup may have been low in July and high in December and January. The situation is likely to change if the company decides to offer a discount on the goods in July, with some future demand shifting to that month. The company should take this into account when making its projection. The following four categories are used to categories forecasting techniques

1. Qualitative: Human judgment and subjectivity are the main components of qualitative forecasting techniques. They are particularly useful when there is a dearth of historical data or when industry professionals have information about the market that could influence the projection. Such techniques might also be required to project demand for a new industry out several years.

2. Time series: Time-series forecasting techniques produce predictions based on previous demand. They are predicated on the idea that historical demand data is a reliable predictor of future demand. These techniques work best when the fundamental demand pattern does not drastically change from one year to the next. These approaches are the simplest to use and make for a solid foundation for a demand forecast.

3. Causal: Causal forecasting techniques use the assumption that the forecast of demand is strongly connected with specific environmental variables such as the state of the economy, interest rates, etc. Using estimations of what the future state of the environment will be, causal forecasting techniques identify this association between demand and environmental parameters and forecast future demand. For instance, demand and product pricing have a close relationship. Therefore, businesses can utilise causal approaches to assess how price promotions affect demand.

4. Simulacrum: Simulation forecasting techniques simulate consumer decisions that result in demand to produce a prediction. A company can use simulation to mix time-series and causal methodologies to respond to queries like: What will the effects of a price promotion be? What effect would a rival opening a store nearby have? Airlines model customer purchasing behavior to predict demand for higher cost seats in the event that lower fare seats are sold out. Choosing the best strategy for forecasting may be challenging for a business. In reality, a number of studies have found that utilizing a combination of forecasting techniques rather than just one improves forecast accuracy.

In this chapter, our main focus is on time-series approaches, which are ideal when the relationship between future demand and past demand, growth patterns, and seasonal patterns exists. There is always a random component to forecasting techniques that cannot be accounted for by past demand trends. A systematic and a random component can be separated out of any measured demand as a result The systematic component, which calculates demand expectations, includes three elements: level, or the current depersonalized demand; trend, or the anticipated rate of rise or decline in demand; and seasonality, or the anticipated seasonal variations in demand. The portion of the forecast that differs from the systematic portion is known as the random component. A business cannot and should not predict the random component's direction. A corporation can only forecast the amount and variability of the random component, which yields a measurement of forecast error.

Filtering out the random component noise and estimating the systematic component are the goals of forecasting. The discrepancy between the predicted and actual demand is measured by the prediction error. An accurate forecasting technique often has an inaccuracy that is around the same size as the demand's random component. A forecasting technique that states it has zero forecasting error on historical demand should raise red flags for a manager. In this instance, the approach combined the systematic component with the historical random component. The forecasting technique will probably perform poorly as a result [4].

Essential Method of Demand Forecasting

An organization must consider the following five factors in order to forecast effectively:

1. Recognize the forecasting process' goal.
2. Integrate forecasting and planning for demand along the entire supply chain.
3. List the main variables that affect the demand projection.
4. Forecast at the proper aggregate level.
5. Calculate the forecast's performance and error metrics.

Recognize the Purpose of Forecasting

The identification of these decisions clearly is a crucial initial step because every forecast supports the decisions that are based on it. Examples of such judgments include how much to produce, how much to stockpile, and how much to order of a specific product. The relationship between a supply chain decision and the forecast should be understood by all stakeholders involved. For instance, since the producer, the transporter, and other parties engaged in meeting demand must all make decisions that are influenced by the projection of demand, they must all be informed of Wal-Mart's plans to discount detergent during the month of July. A joint action plan based on the forecast should be developed by all parties in order to predict the promotion. If these decisions aren't made together, there can be too much or too little product at different points in the supply chain. Supply chain planning and forecasting for demand should be integrated. A business should connect its prediction to all supply chain planning initiatives. These include, among others, purchasing, capacity planning, production planning, and promotion planning. In one regrettably frequent example, a producer creates a different prediction for its production plans based on historical orders while a retailer creates forecasts based on promotional activity.

Poor customer service results from a mismatch between supply and demand caused by this. It is a good idea for a company to have a cross-functional team with people from each affected function responsible for forecasting demand in order to achieve integration; however, it is much better to have individuals from several supply chain organizations collaborate to generate a forecast. Determine the key variables that affect the demand forecast. The next step is for a company to pinpoint the phenomena connected to supply, demand, and product that affect the demand forecast. A business has to know whether demand is increasing, decreasing, or follows a seasonal pattern on the supply side. These projections must be driven by demand, not sales. For instance, in July 2011, a grocery store advertised a certain brand of cereal. Due to this, the demand for this cereal was strong in July as opposed to the demand for other, comparable cereal brands. Because this will only happen if the same brand is marketed again in July 2012 and other brands react as they did the year before, the supermarket shouldn't use the sales data from 2011 to predict that demand for this brand will be high in July 2012.

The supermarket must comprehend how demand is affected by promotions and competition actions as well as what demand would have been in the absence of promotional activity when forecasting demand [4], [6], [7]. Given the scheduled promotional activities for that year, the supermarket will be able to anticipate demand for July 2012 using a combination of these data points. In order to determine the needed prediction accuracy on the supply side, a corporation must take into account the supply sources that are available. An extremely precise estimate might not be crucial if there are other supply sources with short lead periods. A precise estimate, however, will be quite valuable if there is only one supplier accessible and they have a lengthy lead time. On the product side, a company needs to be aware of the amount of product versions being sold as well as whether or not they are interchangeable or complementary. It is better to combine the two projections if demand for one product affects or is influenced by demand for another. For instance, it's possible that demand for an existing

product would fall when a company releases an upgraded version of it since consumers will go for the newer model. Although historical data does not show a drop in demand for the original product, it is nevertheless useful for the company to estimate the combined total demand for the two versions. It is obvious that demand for the two goods should be predicted together.

At the Right Level of Aggregation, the Forecast

It is crucial to anticipate at an appropriate level of aggregation given the supply chain decision that is driven by the forecast since aggregate forecasts are more accurate than disaggregate forecasts. Consider a buyer at a large chain of stores who is predicting to determine the shirt order size. One method is to ask each store manager how many shirts are specifically required, then total up all the requests to get the supplier's order size. The benefit of this strategy is that it makes use of the local market knowledge that each shop manager possesses. This method has a flaw in that it requires store managers to estimate ahead of time, when it is doubtful that their disaggregate forecasts will be accurate. A preferable strategy may be to ask each shop manager to forecast only when the shirts are to be distributed across the stores, rather than asking them to forecast demand at the aggregate level when placing orders with the supplier. In this instance, the supplier order's long lead time projection is aggregated, reducing inaccuracy. Close to the sales season, when local market intelligence is likely to be most useful, the disaggregate store-level forecast is made.

Measures of Forecast Error

Every demand has a random component, as was already mentioned. The systematic component of demand, but not the random component, should be captured by a decent forecasting technique. The forecast error is the result of the random component. Forecast errors must be carefully examined since they carry important information. Managers assess the accuracy of the systematic component of demand using error analysis to assess the present forecasting methodology. For instance, if a forecasting technique frequently results in a positive error, it is likely that the systematic component is being overestimated and needs to be rectified. Forecast error must be taken into consideration in all contingency preparations. Think about a mail-order business with two suppliers. The first has a two-month lead time and is located in the Far East. The second is close by and has a one-week lead time for orders.

The cost of the local supplier exceeds that of the supplier from the Far East. If demand surpasses the supply from the supplier in the Far East, the mail-order company wants to negotiate with the local supplier for a specified amount of contingency capacity that can be employed. The amount of the forecast mistake has a direct impact on the choice of how much local capacity to reduce. Businesses can keep using their current forecasting technique as long as observed mistakes are within historical error estimates. It may be a sign that the forecasting approach is no longer appropriate or that demand has fundamentally altered if an error is discovered that is significantly larger than prior estimates. Another clue that a company should alter its forecasting methodology is if all of its predictions regularly overestimate or underestimate demand.

The Impact It Has on Forecasting

Given the substantial amount of data involved, the regularity of predicting, and the significance of obtaining the highest caliber outcomes, IT has a natural place in forecasting. A key piece of supply chain software is the forecasting module, often known as the demand planning module, found in supply chain IT systems. There are many significant benefits to using IT forecasting capabilities. Commercial demand planning modules include a range of forecasting techniques, some of which are proprietary and highly sophisticated. These methods frequently provide forecasts that are more accurate than those made using a standard

programmer like Excel. The majority of demand planning software programmers allow it reasonably simple to compare different forecasting algorithms to historical data in order to find the one that best fits the observed demand patterns. The availability of a range of forecasting choices is crucial because, based on the actual demand patterns, various forecasting algorithms offer varying levels of quality. Thus, the IT system may be utilised to decide the most effective forecasting techniques for the firm as a whole as well as for individual product categories and marketplaces.

An excellent forecasting tool offers forecasts for a variety of items that are updated in real time to include any new demand data. This enables businesses to react rapidly to market developments and save money by avoiding the expenses of a slow response. Good demand planning modules link directly to customer sales data as well as customer orders, putting the most recent information into the demand forecast. The development in areas like collaborative planning is largely attributable to IT advancements that enable the sharing and implementation of projections between businesses [8].

Finally, as implied by the phrase demand planning, these modules make it easier to shape demand. Tools for performing what-if analysis of the effects of potential changes in prices on demand are present in good demand planning modules. These tools can be used to choose the size and timing of promotions as well as to analyze the effect of promotions on demand. Remember that none of these tools is error-free. Forecasts are almost seldom correct. To be used in making future decisions, historical forecast errors should be tracked by a reliable IT system. A well-organized prediction and an estimation of inaccuracy can greatly enhance decision-making [9], [10].

CONCLUSION

A key component of supply chain management, demand forecasting enables businesses to foresee future customer demand and make strategic decisions. Reducing costs, optimizing inventory levels, improving supply chain responsiveness, and raising customer satisfaction are all benefits of accurate demand forecasting. Organizations must choose the most suitable method for demand forecasting based on data availability, forecasting horizon, and product features. Demand forecasting methods range from qualitative to quantitative. Demand segmentation, collaborative forecasting, and sophisticated analytics are some of the strategies needed to address issues including demand volatility, seasonality, and external influences.

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CHAPTER 13

AGGREGATE PLANNING IN A SUPPLY CHAIN: BALANCING CAPACITY AND DEMAND

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ABSTRACT:

In supply chain management, aggregate planning is a strategic process that entails forecasting and controlling the whole production capacity and demand for a given time horizon. The notion of aggregate planning in a supply chain is described in this chapter, along with its importance in achieving operational effectiveness and customer satisfaction. Meeting client demand while maximizing resources like labor, production capacity, and inventory levels are goals of aggregate planning. It entails predicting demand trends for the future and developing plans to match production capacity with expected demand.

KEYWORDS:

Aggregate Planning, Inventory Levels, Machine Capacity, Plan, Production Schedule.

INTRODUCTION

Imagine a world where the capacity for manufacturing, transportation, warehousing, and even information is unlimited and unrestricted. Imagine having 0% lead periods, which would enable things to be created and delivered right now. In this universe, there would be no need to prepare for demand because any time a buyer placed an order for a product, the order would be filled right away. Aggregate planning has no place in this planet. However, in the actual world, lead times are frequently very long and capacity has a price. Therefore, decisions about capacity, production, outsourcing, and promotions must be made by businesses before the demand is known. A business must foresee demand and plan how to satisfy it before it arises. Should a business spend money on a plant with a huge capacity that can meet demand even during the busiest seasons? Or should a business construct a smaller facility and bear the costs of keeping stock made during slow times in anticipation of demand in later months? These are the kinds of inquiries that aggregate planning aids businesses in addressing.

A corporation sets expected levels of capacity, output, subcontracting, inventory, stock outs, and even price through the aggregate planning process over a given time frame. Aggregate planning is to create a strategy that meets demand while maximizing profit. As the name implies, aggregate planning deals with challenges involving aggregate decisions as opposed to decisions at the stock-keeping unit level. For instance, aggregate planning establishes a plant's overall production level for a specific month, but it does not specify the quantity of each specific SKU that will be produced. Aggregate planning becomes a valuable tool for considering decisions with an intermediate time period of between about 3 and 18 months thanks to this level of depth. While it is normally too late to make arrangements for more capacity at this point, it is also too early to estimate production levels by SKU [1], [2].

Therefore, aggregate planning provides a solution to the question: How can a company make the greatest use of the facilities it already has? The supply chain's effectiveness is greatly impacted by aggregate planning because it needs input from every level to be effective. As we saw in the chapter on forecasting before this one, collaborative predictions are made by several supply chain firms and are a crucial component of overall planning. Furthermore, a

large number of limitations that serve as important inputs for aggregate planning originate from supply chain partners outside the organization. The value-creating potential of aggregate planning cannot be fully realized without these inputs from both the top and bottom of the supply chain. Both partners upstream and downstream value the outcomes of aggregate planning. Production plans for a company establish supply limitations for customers and define demand for suppliers.

This chapter aims to lay the groundwork for the use of aggregate planning throughout the entire supply chain as well as just within an organization. Where we examine sales and operations planning, will further clarify the consequences of aggregate planning for the supply chain. Think about how an elite chapter supply chain employs collective planning to boost profits as an illustration. Seasonal demand affects a variety of chapter mills, with ripple effects from consumers to printers to distributors to manufacturers. When annual reports are written in the spring and new automobile brochures are released in the autumn, demand for several types of premium chapter reaches its height. Due to the high cost of mill capacity, it is very expensive to construct a mill with enough capacity to meet demand on an as-needed basis in the spring and autumn [3].

On the other end of the supply chain, specialty additives and coatings are frequently needed for premium chapters but may be in short supply. These limitations must be managed by the chapter manufacturer in order to maximize profit. Aggregate planning is used by mills to establish production levels and inventory levels that they should accumulate during the slower months in preparation for sales in the spring and fall when demand is higher than the mill's capacity. Aggregate planning enables the mill and the supply chain to maximize profit by accounting for inputs from every link in the supply chain. The primary goal of the aggregate planner is to determine each of the operational parameters listed below over the given time horizon:

1. **Production Rate:** The quantity to be accomplished in a certain amount of time, such as a week or a month.
2. **Workforce:** the total number of employees or production units required the anticipated quantity of overtime production
3. **Machine Capacity Level:** the quantity of machines with the required production capacity Subcontracting: the capacity that must be subcontracted over the planning horizon
4. **Backlog:** a demand that is not met in the immediate period of time but is postponed to a later period.
5. **Inventory on Hand:** the anticipated stock kept over the various planning horizons the overall plan acts as a general guide for operations and provides the parameters within which decisions regarding immediate production and distribution are made.
6. The supply chain is free to renegotiate supplier agreements and capacity allocations thanks to the overall plan. The entire supply chain should be involved in the planning process, as was described in prior chapters. The supplier, transporter, and warehouse must be aware of and take into account any production increases that a manufacturer has anticipated over a specific time period.

Determining the Total Units of Production

Finding a proper aggregate unit of production is a crucial initial step in aggregate planning. Although planning is done at the aggregate level, it is crucial that the aggregate unit be identified in such a way that, when the final production schedule is built this must be done at the disaggregate product level, the outcomes of the aggregate plan roughly reflect what can be accomplished in practice. Given that the bottleneck is probably the part of a manufacturing facility that is most constrained, it is crucial to concentrate on the bottleneck while choosing

the aggregate unit and determining capacity as well as production times. It's crucial to take setup and maintenance durations into consideration when estimating production times because they consume capacity without producing anything.

DISCUSSION

A plan that cannot be implemented in practice if the aggregate plan overestimates the production capacity that is actually available. We now go over a straightforward method for identifying aggregate units as well as assessing costs, revenues, and times for this aggregate unit. The aggregate planner must compromise between inventory, backlog costs, and capacity. Usually, a combined plan that increases one of these prices will decrease the other two. The expenses are a compromise in this way a planner must either raise capacity costs or put off client deliveries in order to reduce inventory costs. The planner exchanges inventory cost for capacity or backlog cost as a result. Aggregate planning aims to arrive at the most profitable mix of trade-offs. Given that demand fluctuates over time, the planner's ability to maximize profits depends on one of the three costs due to their relative levels.

It may not be necessary for a business to carry backlogs or accumulate inventory if the cost of altering capacity is cheap. A business may store up some inventory and carry certain backlogs from peak demand periods to off-peak demand periods if the cost of adjusting capacity is significant. In order to best meet demand, a corporation often tries to combine the three costs. Consequently, among the basic trade-offs a planner can make are Backlog/lost sales due to delay; Capacity regular time, overtime, subcontracted; Inventory To achieve a balance between these expenses, there are fundamentally three different aggregate planning methodologies. These tactics entail making trade-offs between capital expenditure, employee headcount, work hours, inventory, and backlogs/lost sales. The majority of the tactics a planner actually employs include all three, and are referred to as customized or hybrid tactics [4], [5].

These are the Three Techniques

1. The chase approach, which uses capacity as a lever by adjusting machine capacity or recruiting and firing workers in response to changes in the demand rate, the production rate is synchronized with the demand rate using this approach. The difficulties of adjusting capacity and manpower on short notice makes it difficult to achieve this synchronization in practice. If the cost of modifying machine or labor capacity over time is high, putting this method into practice could be expensive. Additionally, it may have a very detrimental effect on employee morale. Low levels of inventory in the supply chain and significant capacity and labor change are the effects of the chasing strategy. It should be utilised when carrying inventory is expensive and changing machine and labor capacity levels is inexpensive.

2. Utilization as the lever for flexibility this method may be employed if there is extra machine capacity i.e., if machines are not operated continuously throughout the day, every day of the week and the workforce exhibits flexibility in their work schedules. In this scenario, the workforce capacity is maintained constant, but overtime is changed over time to try to synchronize production with demand. To achieve this synchronization, a planner may employ a flexible timetable or varying amounts of overtime. Although this technique does necessitate a flexible staff, it does so without some of the drawbacks of the chase strategy, most notably the need to alter the workforce's size. Low quantities of inventory are produced by this technique, but average machine utilization is also low. When machine capacity is relatively cheap and inventory carrying costs are relatively high, it should be used.

3. Adopting inventories as a lever while adopting a level strategy with this tactic, a steady output rate is maintained together with a stable machine capacity and personnel. Stock levels change over time as a result of shortages and surpluses. Production in this situation is not in

line with demand. Either backlogs are carried over from high- to low-demand times, or stocks are accumulated in anticipation of future demand. Stable working circumstances are advantageous to employees. This technique has the disadvantage that enormous stockpiles may build up and client orders may be delayed. This tactic keeps capacity and the price of increasing capacity at a manageable level. When inventory carrying and backlog expenses are low, it should be used. In actuality, a planner is more likely to develop a customized or hybrid strategy that incorporates elements from all three strategies. We go over a method that is frequently employed for aggregate planning in the following section.

Linear Programming-Based Aggregate Planning

As we previously stated, aggregate planning aims to maximize profit while satisfying demand. Every business must contend with limitations in order to meet client demand, such as the capacity of its facilities or a supplier's ability to deliver a component. When a business is trying to maximize earnings while being subject to a number of restrictions, linear programming is a very powerful technique it can use. In accordance with the company's restrictions, linear programming identifies the solution that maximizes profit. Through the explanation of Red Tomato Tools, a small producer of gardening tools with production facilities in Mexico, we demonstrate linear programming. The products of Red Tomato are distributed through American stores. Red Tomato's business is the assembling of pre-purchased components into a versatile gardening tool. Red Tomato's capacity is primarily based on the amount of its staff due to the limited space and equipment needed for its assembly processes. We choose a six-month time frame for this example because it is a sufficient length of time to highlight many of the key ideas of aggregate planning.

Tomato Red Tools

Customers' demand for Red Tomato's gardening tools is incredibly seasonal, reaching its height as people start their gardens in the spring. The merchant and producer, Red Tomato, are both affected by this seasonal demand as it moves up the supply chain. Red Tomato has a several options for dealing with seasonality, including hiring more people during busy times, outsourcing out some tasks, stockpiling items during slow times, and accumulating a backlog of orders that will be delivered to clients after the expected time [5]. The first task creating a demand forecast is when Red Tomato's vice president of supply chain begins to determine how these possibilities should be used in an overall strategy. Red Tomato may make an effort to predict this demand on its own, but the projection was created through a collaborative approach between Red Tomato and its retailers. It is critical that this demand take into consideration the predicted product mix and be expressed in terms of the total units already established.

Creating a Basic Production Schedule for a Master

A planner must take an aggregate plan, break it down into its component parts, and create a rough master production schedule that lists the batches produced during each period at the level of each product family. To demonstrate a straightforward method for breaking down an aggregate plan, we refer back to the Red Tomato example. Even though this strategy may not always be the best one, it is easy to adopt and enables a feasibility check. If a planner wants to look for better solutions, more advanced techniques are available. These approaches, however, are challenging to use and might not be able to capture all of the complicated reality. We suggest this straightforward method for this reason. The first stage is to distribute the 2,560 units of production among the six families.

We do this using the predicted sales ratio as. So, since Family an account for 10% of sales, the objective is to create 256 units in Period 1. Finding the approximate number of scheduled batches for each family is the next step. We divide the projected production amount by the

typical batch size and round the result down to determine the viability of the plan. The anticipated number of setups batches for Family A is 256/50, or 5.12 rounded down. As a result, Family a batch generated during this time will typically be greater than 50. For each of the remaining families in Period 1, we similarly arrive at the anticipated number of setups batches, We compute the setup time and the production time for the anticipated number of e to determine whether the intended timetable is feasible.

It's Impact on Aggregate Planning

Possibly the supply chain area where information technology has been applied most frequently is aggregate planning. Aggregate planning modules often referred to as factory, production, or manufacturing planning were the first IT supply chain products. Early modules sometimes concentrated solely on creating a production plan that could be carried out within the restrictions of demand and capacity. Later modules offered tools that, depending on goals like increased output or decreased cost, selected the best option from among the feasible production plans. The aggregate planning problem was typically described in these traditional methods as a linear programmer in order to obtain a production schedule of the goods to be manufactured during each period of time. To take into consideration the fact that not all constraints or rational goal functions are linear functions, certain planning modules now include nonlinear optimization [6], [7].

However, given the vast quantity of data taken into account while creating aggregate plans, which can make nonlinear problems computationally prohibitive, and the ability to generate linear approximations of nonlinear functions, linear programming is frequently the best approach to solving these issues. Production planning and inventory planning are frequently combined in modern supply chain planning modules. The forecasting module's output is used as a constraint by the supply chain planning module to establish the production schedule and inventory levels. The execution system uses these production plans and inventory levels to determine the actual manufacturing of the commodities and the inventory levels to be used throughout the supply chain. Given the intricacy of the issue, aggregate planning modules can even benefit small businesses significantly. IT may improve the aggregate planning process in a number of ways, including:

1. The capacity to deal with significant issues.
2. The capacity to tackle complicated issues either through nonlinear optimization or linear approximations.
3. The capacity to communicate with other key IT systems, such as sourcing and inventory management.
4. Due to the complexity of aggregate planning issues, IT is frequently the only path to a workable solution.

In order to give management a general idea of how much inventory and other resources should be purchased and when, aggregate planning is a marketing activity that plans the production process in advance of 6 to 18 months. This helps to ensure that the organization's overall operating costs are kept to a minimum during that time. It is decided how much will be outsourced, subcontracted, worked overtime, employed and fired during each period, and how much inventory will be kept on hand and backlogged throughout each period. All of these actions are taken in accordance with the company's ethics, policies, and long-term commitment to the local community, society, and operating nation. Certain prerequisite inputs for aggregate planning are unavoidable.

They consist of Information about the facilities and resources that are offered. Forecast of demand for the time frame for which planning is required. The price of various options and resources. This covers the price of maintaining inventory, the price of placing orders, and the price of production using different production techniques like subcontracting, backordering,

and overtime. Organizational guidelines for using the aforementioned options. In aggregate planning, output supply and demand are matched across a medium time horizon, up to about a 12-month horizon. When planning is referred to as aggregate, it means that there is only one overall output measure or, at most, a small number of aggregated product categories. Aggregate planning's objective is to establish overall output levels for the short- to medium-term in the face of varying or ambiguous demand. Planning at the aggregate level may aim to influence both supply and demand.

Putting Combined Planning into Practice

Consider the entire supply chain in addition to the business. Today, the majority of aggregate planning uses the enterprise as the only unit of analysis. The best aggregate strategy, however, can be greatly impacted by a variety of external circumstances that exist throughout the supply chain and outside the company. Therefore, when planning, do not fall into the trap of focusing just on your business. Work with all supply chain participants who can enhance the quality of the inputs to the overall plan, including downstream partners who can generate predictions, upstream partners who can identify bottlenecks, and any other supply chain entities. The quality of the inputs will determine how effective the plan is. Therefore, employing the supply chain to raise input quality will significantly raise the quality of the overall plan. Make sure to inform all supply chain partners who will be impacted by the overall plan as well [7].

Be flexible with your plans because projections are never correct. Plans for aggregates are based on projections of future demand. The aggregate plan must be flexible in order for it to be useful, as these forecasts are inherently unreliable to some extent. By including flexibility into the strategy, it will be able to respond effectively to changes in future demand or other factors, such as cost increases. How can we achieve this adaptability? Along with the recommendations made previously in the chapter, we advise managers to run sensitivity analyses on the inputs to an overall strategy.

For instance, if the plan calls for increasing costly capacity in the face of uncertain demand, consider what would happen if a new aggregate plan were to be implemented while demand was higher and lower than anticipated. If this analysis finds only modest cost savings from increasing capacity while demand is high but a significant cost increase when demand is lower than anticipated, delaying the capacity investment decision may be an appealing choice. Planners can select the optimum option for the range of potential outcomes by performing sensitivity analysis on the inputs into the aggregate plan. As new data come in, run the aggregate plan again. As previously noted, aggregate plans offer a road map for the following three to eighteen months. This does not imply that a company should only perform aggregation plans every three to eighteen months.

Managers should use the most recent values of these inputs and rerun the aggregate plan as inputs, such as demand projections, change. The strategy will prevent sub optimization based on outdated data and produce a better result by employing the most recent inputs. As capacity use rises, use aggregate planning. Surprisingly, a lot of businesses don't make aggregate plans and instead base their production schedules completely on the orders they receive from their distributors or warehouses. Either actual demand or algorithms for inventory management drive these orders. The absence of aggregate planning may not materially affect a company if it is able to meet demand effectively in this way. However, relying on orders to determine the production schedule might result in capacity issues when utilization rises and there is a problem with capacity. When utilization is high, there is a limited probability of producing for all orders as they come in. Planning must be done to make the best use of the available resources to satisfy the anticipated demand. As a result, aggregate planning becomes increasingly crucial as capacity utilization rises [8].

Summary of Learning Goals

Identify the decisions that aggregate planning is best suited to tackle. The ideal use of aggregate planning is to make decisions about capacity, production, and inventory for each time period over a period of 3 to 18 months. Aggregate planning is particularly crucial when capacity is constrained and lead times are lengthy. Recognize the significance of supply chain activity called aggregate planning. The performance of the supply chain is significantly impacted by aggregate planning, which must be seen as an activity involving all supply chain participants. The limitations from the supplier stage and the requirements from the customer stage are not taken into consideration in an aggregate plan created by a company alone, hence it is not very beneficial. It is impossible for localized aggregate planning to effectively balance supply and demand. Because precise input is needed from all levels, good aggregate planning is done in partnership with both customers and suppliers. The quality of these inputs impacts the quality of the overall plan in terms of both the demand projection that must be met and the constraints that must be handled. The aggregate plan's outcomes must also be communicated to all parties involved in the supply chain because they have an impact on both suppliers' and consumers' operations. The aggregate plan establishes the anticipated orders for suppliers and the planned supply for customers. Specify the data required to create an aggregate plan. A planner needs a demand estimate, cost and production data, and any supply restrictions in order to build an aggregate plan. A demand estimate for each time period in the planning horizon makes up the demand prediction. The production and cost data include capacity levels, the expenses associated with increasing and decreasing them, production costs, costs associated with storing the product, costs associated with stocking out the product, and any limitations placed on these aspects. Limitations on outsourcing, overtime, or materials are based on supply. Describe the fundamental trade-offs to take into account while developing an aggregate plan. To maximize profitability, the fundamental trade-offs entail balancing the costs of capacity, inventory, and stock outs. The planner can lower the other two by increasing any one of the three. Use Microsoft Excel to create and resolve aggregate planning issues. Excel may be used to address aggregate planning issues by setting up cells for the objective function and the restrictions, then using the Solver to generate the answer.

Advantages

Aligning Demand and Capacity: Aggregate planning enables businesses to match their production capacity with expected demand. Organizations may make sure they have the right amount of labor, resources, and equipment to meet consumer demands while avoiding overcapacity or underutilization by anticipating and matching demand trends.

Cost Optimization: By coordinating production, purchase, and inventory levels, aggregate planning enables businesses to reduce costs. Organizations can cut stock outs, prevent expensive rushed manufacturing, and reduce inventory holding costs by anticipating demand and modifying production schedules accordingly.

Production Efficiency: Organizations can increase their production efficiency by using effective aggregate planning. Organizations may cut down on idle time, lessen bottlenecks, and boost overall productivity by balancing workloads and efficiently using resources. Cost reductions and improved operational effectiveness result from this. Aggregate planning helps organizations provide better customer service by guaranteeing that they can quickly meet demand from customers.

Making Strategic Decisions: Aggregate planning offers organizations useful information for making strategic decisions. Organizations might find chances for expansion, investment in new facilities or equipment, or prospective partnerships to satisfy future demand

requirements by analyzing demand patterns and capacity utilization. It enables organizations to choose wisely when allocating resources and planning long-term capabilities [9], [10].

CONCLUSION

A key step in supply chain management is aggregate planning, which enables businesses to proactively match production capacity with expected demand. Organizations can improve operational efficiency, lower costs, and higher customer satisfaction by wisely managing resources, optimizing production levels, and modifying inventory levels. There are many benefits to aggregate planning in a supply chain. By coordinating production with demand and reducing underutilization or overcapacity, it increases resource utilization. Cost reductions and increased production result from this. Optimized inventory levels ensure prompt customer order fulfilment and improved levels of customer service by lowering holding costs and preventing stock outs. In order to fulfil future demand requirements, organizations can also strategically decide to expand their capacity, plan their staff, and pursue collaboration options.

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