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IMPACT OF QUANTITATIVE TECHNIQUES ON THE EFFECTIVENESS OF SUPPLY CHAIN STRATEGIES IN B2B IN IRAQ

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Signature

DEDICATION

I dedicate this practical effort to my sun and my moon, my parents who sacrificed everything in order to provide a perfect life for me, to all my family members, to every friend and relative who supported me throughout my study period. To all of them, I say thank you very much.

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ABSTRACT

IMPACT OF QUANTITATIVE TECHNIQUES ON THE EFFECTIVENESS OF SUPPLY CHAIN STRATEGIES IN B2B IN IRAQ

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In most research, statistical techniques are used as a tool to reach the results of research hypotheses through statistical investigation and data collection necessary for that research, but we rarely find in libraries and websites research that takes statistical techniques as an independent variable whose effects on the rest of the variables are discussed. Therefore, this research sheds light on the importance of this tool and its impact on supply chain management strategies, which are characterized by its large scale of work when compared to the rest of the businesses and departments of companies. Also the role of data analytics in helping companies to manage their supply chain, evaluate their experience and strategies and implement them successfully. And since this research talks about the role of the quantitative method techniques, it was necessary to use the qualitative method through interviews to show its features and determine its effect (the opposite is known as the opposite).

Keywords: Quantitative Techniques, Supply Chain Strategies, B2B, Decision Process, Data Analysis.

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LIST OF ABBREVIATIONS

SC : Supply Chain

SCM : Supply Chain Management

SD : Supplier Development

1. INTRODUCTION

Transacting from one firm to another via the internet is known as business-to-to-business (B2B) transactions (B2B). A third party (an intermediary) helps connect buyers and sellers in business-to-business transactions so that they can interact with each other directly or through an intermediary. B2B e-Marketplace sales transactions are expected to exceed $2.7 trillion in 2004, according to IBM, according to a Gartner Group analysis, IBM (2001).

Companies in the B2B sector can be categorized as either horizontal or vertical. Companies that operate exclusively in a single industry, such as e-commerce, make money by selling advertisements on industry-specific websites or by charging commissions on transactions. Internet Capital Group and Vertical Net are two of the largest vertically-oriented B2B corporations, each with a vast number of subsidiaries operating in many industries, Roberti (2000).

Firms that run horizontally are distinct from those that operate vertically since they operate at several levels and in various verticals, respectively. The software and services sold by Ariba, i2, and Siebel Systems are instances of horizontal businesses making money. Electronic raw material production is made possible by Ariba, while increased productivity is made possible by i2. The four categories of exchanges are retailers, distributors/market makers, and content aggregators. The most typical type of exchange is one conducted by the buyer, Gereffi, (2001).

For the most part, these transfers take place privately and are overseen by technology partners and large buyers. This method may also be employed by sourcing networks, which are groups of buyers who pool their resources to make larger purchases. The procurement process is usually sped up, administrative costs are reduced, and prices are maintained, Aissaoui (2007).

Buyers coordinate 90% of all transactions, and these transactions all take place within the buyer's network. The purchaser is responsible for hosting and updating the website's content. When it comes to others, they're not available to the public, are housed elsewhere, and are meant to draw in other purchasers from inside the same industry. Suppliers will be requested to make their catalogues available to clients on these private and public exchanges. Due to the buyer's often having authorization, these transactions are easy to set up.

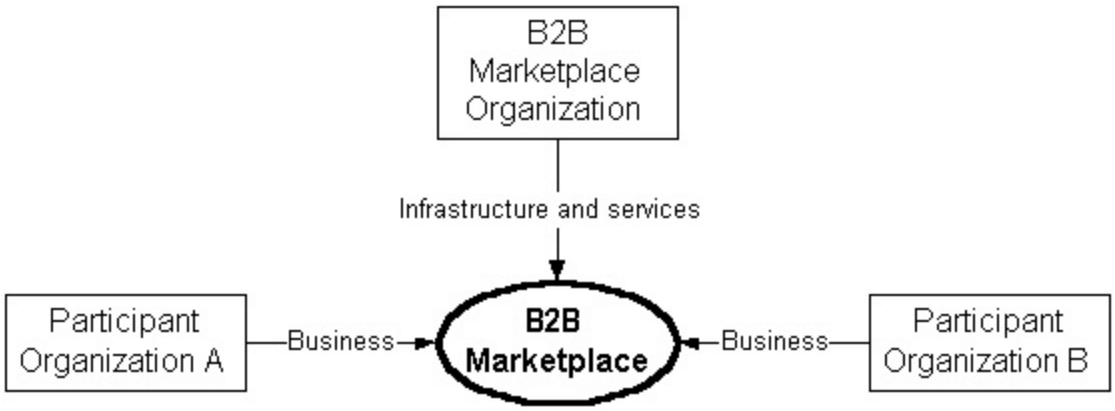


Figure 1.1: B2B marketplace organization

Supplier-managed exchanges are typically set up by market share leaders or companies that have a specialized, proprietary product. If you're a large supplier or distributor with a wide range of customers, you could be better off creating your own marketplace. As an alternative, customers can form a large number of smaller exchanges, each managed by a different buyer.

Non-affiliated exchanges (distributors/market makers) are exchanges where buyers and sellers have equal influence. A popular sort of startup is a venture-backed firm founded by a former dotcom pioneer. Distributors might charge more for their services if they can distribute anonymously. Market makers in the world of trading try to generate money by matching orders

and charging transaction fees. Auction houses can be segregated from real-time bid/ask systems, for example, Gereffi (2001).

Content aggregators build and manage multi-vendor catalogues. Sixty percent of vendors continue to utilize paper catalogues Nearly a third of all digital catalogues are of poor quality, feature numerous abbreviations or duplication, or were created with the intention of being read by machines only. You can use Requisite Technology to scan and clean up your paper content before organizing it for parametric searching with Requisite Technology's help. Before a piece of content can be published online, it must first be approved by a content aggregator, Wang (2004).

Numerous benefits can be derived from the B2B method. You can save money on purchases, to begin with. Changing the way, a company purchases raw materials is one of the simplest methods to save money. According to the National Association of Purchasing Managers, manual purchase orders are $79 on average. This is the case since gathering necessary supplies and then completing appropriate paperwork take time. Online shopping saves you time by making it easier to find what you want and to place an order.

The B2B method also enhances the market's efficiency. Through the Internet, businesses may easily and rapidly get price quotes from a wide range of service providers, including their own. Increasing the number of buyers above the number of sellers will result in a better offer for buyers and a better bargain for sellers. When B2B hosts bring buyers and sellers together, it's a lot like how eBay has established a robust market for everything from Barbie toys to vintage Atari games.

Better market intelligence is also an important consideration. Suppliers benefit from better rates when B2B hosts let them see how much demand there is in a certain area. Anything from paint

pigments to plastic cups can instantly generate spot pricing levels... As a result, businesses may be in a better position to decide what to produce and what not to produce, CyberAtlas (2001).

The selling of goods and services where the order taking procedure is completed online is termed B2B e-commerce by Gartner Group Exclusive network activity is prohibited from purchases done through Internet EDI, e-marketplaces, extranets and other sell-side efforts. To get at the $2.4 trillion estimate, Gartner looked at the total value of non-financial B2B goods and services sold, resold, or brokered over the Internet by businesses.

Most businesses search for profit maximization through various managerial and functional strategies and decisions employed. The decision makers in the businesses allocate adequate interests and spend huge efforts to minimize the costs which represent the controllable element that a business can relatively affect or influence on it compared with other external or non-controllable factors, Bello (2012).

Producing goods requires not only huge portions of materials supplies and components but also comparing them with services. The analysis of the materials consumed by goods may range between 55% up to more than 90% for some goods. This huge portion of the total cost will enable the business when managing efficiently and effectively the supplying processes and transactions through building and sustaining mutually profit relationships with the suppliers through SCM (supply chain management) any reduction in the supplying process which can resulting from multiple stages of the supplying started from the well identification and effective evaluation of the existing suppliers up to the issuance of the materials or components to the manufacturing processes, Kersten (2017).

Using supply chain management (SCM), companies may link their operations with those of all of their strategic suppliers, as well as important intermediaries and consumers. In order to assist second-, third- and fourth-tier suppliers in achieving quality, delivery and timely information exchange demands, the method combines the connections and operations of immediate, first-tier suppliers with those at many tiers back in the supply chain Large suppliers are solicited and directly involved in the development of new products by companies that use supply chain management. By managing supply chain costs and tying supplier skills to new product development, the purchasing function improves corporate performance in many firms, Gurin (1999).

The reduction in the materials costs within the journey of the materials through the supplying process especially when employing quantitative techniques in determining the adequate purchased quantities, the percentage of acceptable spoilage or damages, or any other quantitative techniques supported with the various evaluations of the suppliers. This will lead to significant savings in the total costs of the products and encourage the business to either sustain the existing selling prices which increase the profits obtained or decrease the selling price and be more differentiated than the competitors in the industry, Bode (2012).

This reduction in the prices will not only enable the business to capture a competitive advantage than competitors in the market, but also increase the perceived value of consumers which raise their satisfaction and loyalty and prevent their switching to the competitor's products. The continuous analysis and studying of the supplying processes and how effectively employ various quantitative techniques supported with the computer applications and software which ease the employment process of these quantitative techniques will assist the businesses to control more on the supplying costs and prevent any huge fluctuations in the costs, Barratt (2004).

The differentiation in the market in the era of globalization not only required to improve the existing business and expand domestically or internationally, but also a way to be survived and sustained in the dynamic competition environment. These dynamics impose businesses to create and innovate various ways to decrease costs. Employing the quantitative techniques in the supplying process enable businesses to achieve unique position in the market and simply win all the competitors. Either Wal-Mart or Amazon, when employing adequate supply chain management and quantitative techniques, enter the club of billions within few decades. Wynstra (2019).

The reduction in the costs of the materials used is not the ultimate or unique goal of the supply chain management process, the increases in the amount of information available for the various operations and transaction, reduction the business complexity as possible, and finding a comprehensive concept of supply operations and this beside the ensuring of the continuous flows of the required materials at the right time and quality with reasonable prices will be the greatest advantage among all the competitive advantages that businesses can capture in the dynamic competition environment, Al-bayati (2011).

The execution of a supply chain strategy is crucial in today's globalizing company environment. Implementing a supply chain strategy (SC) might be tough for a company operating in a dynamic business climate with complicated supplier chains that are not connected. Suppliers should be involved in the SC strategy as well as the company's supply chain. Strategic management and strategy execution, supply chain management (SCM), and supplier development have been the focus of research in the past (SD). All companies and activities involved in all stages, from product or service manufacturing to consumption, are part of a company's supply chain. An improved

relationship between the enterprises in the supply chain results in maximum performance and maximum profits for everyone, Stevenson (2014).

In order to improve business performance and competitiveness, supply chain management (SCM) makes use of these strategic links. To put it another way, the success of the supply chain and the business are dependent on the reinforcement of the supply chain strategy. Several supply chain strategies have been presented to deal with demand and supply. ERP, VMI, CPFR, WMS, outsourcing strategies, and organizational competences are some examples of these, Tajba, (2015).

Products are owned by distributors when distributors sell them to clients as part of collaborative relationships between suppliers and distributors, according to Disney and Towill (2008). By lowering the bullwhip effect, which occurs when inventory moves up the chain among companies further away from the client, supply chain methods can increase information flow between firms in the chain [20]. These tactics can also enhance the relationship between distributors and suppliers, which leads to faster delivery times and fewer product shortages, Tajbakhsh, (2015).

This ERP installation technique may be based on a common repository that streamlines workflow by unifying disparate systems into a single database. In order to reduce the bullwhip effect and improve product scarcity, inventory levels, and customer service levels, the CPFR strategy uses an accurate sales prediction method, Sherman (1998).

The WMS strategy controls the warehouses as a whole, allowing inventory information to be used to reduce inventory as efficiently as possible throughout the supply chain. Operational and financial performance are directly related to SCM techniques in these situations. Mentzer et al. [2001] and Alfalla-Luque et al. [2015] agree that supply chain integration has a positive impact on

operational inventory management and financial performance through managing costs, quality, inventory, and delivery.

When it comes to efficiency, new research shows that inter-firm supply chain approaches are effective in helping companies achieve a single goal across many sectors, from procurement to production to distribution to sales. There are a few studies that have only applied their findings to small and medium-sized businesses, such as Closs et al. (2001), Lee (2002), Mentzer et al. (2001), and Meixell and Gargeya (2005).

Internet of Things (IoT), cloud computing and artificial intelligence (AI) have spurred the fourth industrial revolution with their widespread adoption and growth in recent years. As a result, in the face of these rapid changes, adopting novel methods for SMEs' survival and growth is a top priority. Organizations' logistics networks will be able to become more modular and networked quickly when the fourth industrial revolution and changes in distribution structure arrive. Since the logistics supply strategy needs to be reevaluated at the corporate level, merging organizational skills is required, Fynes (2004).

The traditional managing of the supply chain through building and sustaining good relationships with the suppliers enable businesses to achieve reasonable differences in the costs of the materials used and supported with reasonable enhancement in either the continuous flows of the materials, supplies used the acceptable quality of these materials. These superior results can be improved greater when implementing various quantitative techniques that can enhance and improve the effectiveness of the supply chain which in turn improve the beneficiary of the businesses and support its competitive advantage in the market, Ahmed (2019).

The implementation of the quantitative techniques in the supply chain management can be easily traced on the performance of businesses that deal with end consumers (B2C) and this can be learned from the practices performed by giant corporations such as Wal-Mart which achieve the majority of its success and expansion from its adequate investment in computer systems and applications that deal with the effective and efficient management of its inventoriable items and supplying processes, Giménez (2004).

1.1 RESEARCH PROBLEM

The goals of the supply chain for businesses are not only to sustain the existence of the businesses through the continuous flows of various materials and supplies needed and required for the manufacturing, but to participate, engage heavily and strongly processes. It also aims to enhance the various activities, operations and transactions related to the material handling and acquisition to as possible minimize the cost of the materials, the highest portion in the total manufacturing costs which enable businesses to be clearly differentiated and achieve reasonable profits.

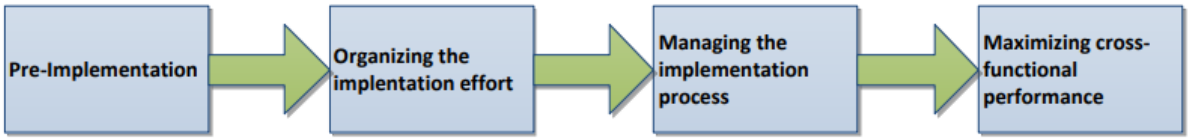


Figure 1.2: Strategy implementation stages

Many academics [32-36] believe that SC strategy must be in line with business strategy in order to be effective. According to [34], two-thirds of respondents said their SC strategy was important or extremely important to the company's overall strategy. Despite this, there is still a significant divide between business and social responsibility efforts today (2012).

The relationship between SC strategy and corporate strategy, as well as the several subfields of SC strategy, have a number of holistic frameworks. As a result of the corporate strategy, the goal of the SC strategy is to strike a balance between responsiveness and efficiency. Three logistical elements: facilities, inventory, and transportation; and three cross-functional drivers: information, sourcing and price, must be structured correctly by a company in order to attain this goal. In their model, Chopra and Meindel (2007) distinguish responsiveness from efficiency and cost leadership. These additional instances come from.

With supplier development (SD), the SC strategy may be put into action across the whole supply chain. The performance of customers and suppliers is influenced by SD infrastructure elements (2004). For better performance and capabilities, purchasing organizations utilize transaction-specific SD (1993). Technology and product development should priorities future capabilities over current quality and pricing (1999).

A company's SC strategy depends on SD since it makes sure suppliers' performance and capabilities are in line with what the buying company requires. Manufacturing organizations increasingly depend on the performance of their suppliers to establish and maintain a competitive edge. It has also been studied how SD programs effect buyers and suppliers' performance in the purchasing process Supplier development (SD) is something buyers undertake to keep tabs on and improve the quality of the products and services they receive from their suppliers. Purchasing organizations tend to concentrate their efforts on a small number of critical vendors (2001).

Motivating customers as well as providers requires effective communication (1993, 2011). It is easier for both sides to understand and settle disagreements when there is excellent communication. Suppliers are more willing to change their operations to meet consumer expectations when a customer is long-term committed (2010). A provider's aptitude to improve its performance and capabilities relayed on the trust buyers and suppliers have in one another.

To find out how quantitative methodologies used in supply chain operations and supply processes can improve the efficiency of supply chain strategies utilized in B2B companies is the goal of this research.

1.1.1 Research Questions

This research aims to observe what influence quantitative techniques have to efficiency of supply chain strategies used in B2B.

There are several sub-questions that need to be addressed in order to answer this question:

- What quantitative techniques can B2B enterprises employ to their advantage?
- In SCM, what are the advantages of employing quantitative techniques?
- When using quantitative techniques in the SCM, how can organizations quantify the increase in revenues and performance?

1.1.2 Research Hypotheses

This research aims at assessing the rationality of the following hypothesis;

H_0 A significant positive relationship between the implementation of the quantitative techniques and the effectiveness of SC strategies employed in B_2B.

H_1 A significant positive relationship between the implementation of the quantitative techniques and the enhancement in revenues, and performance in B_2B.

1.2 RESEARCH AIM AND OBJECTIVES

One of the biggest challenges in a fast-paced business environment is implementing the SC strategy. Profitability and efficiency can be improved by implementing an integrated strategic planning process through quantitative techniques that includes suppliers and partners as well as the company's own corporate structure. Studies of SC strategy implementation are fragmented and lack appropriate frameworks, which creates a research gap in the literature. Based on the research gap, a research goal and research questions are outlined.

1.2.1 Main Aim

This research aims mainly to investigate about how quantitative techniques that can be used in supplying processes and supply chain operations can affect the effectiveness of the supply chain strategies employed in B2B businesses.

1.2.2 Secondary Objectives

This researcher intends to attain the following objectives:

1- Detect the significance of supply chain strategies that can be employed in B2B.

2- Assess the validity of the quantitative techniques that can be used in supply chain in B2B businesses.

3- Measure how the quantitative techniques can improve the effectiveness of the strategies implemented and employed in B2B businesses.

1.3 RESEARCH IMPORTANCE

The rapid technological changes that are leading to lower market price and obsolescence have led to the consideration of the rapid response production strategy to market demand. This study examines a strategic production to determine the ultimate production line as a result of market demand fluctuations and a steady stock degradation. The demand rate is supposed to decline exponentially over time, but the price would decline linearly. The aim of this study is to derive the most inexpensive site of the final product line assembling short-lived items.

Due to the huge expansion and usage of electronic vehicles and applications in the electronic commerce as these style of commerce expected to substitute the traditional businesses as electronic businesses more efficient, more effective and enable businesses to be global through investing nothing compared with the traditional businesses. This research will enable businesses that deal mainly with other businesses to achieve unique performance through choosing the most suitable quantitative techniques that can be used to improve the effectiveness of the supply chain strategies.

Supply chain aspects include **production, storage**, **and distribution and information** flow management. It focuses on maintenance, acquisition, distribution and inventory management. The model taken into account in the study includes income for sales, deterioration costs, transportation costs, variable costs and fixed manufacturing cost. Although the production site is near a market point with greater labor and material costs, the total profit rises as the time is fastest, import taxes decreased, inventory decreases and costs decreased.

To ensure transparency and improved efficiency: Companies seek to reduce the cost of supply chains in order to achieve higher cost-saving measures. Supply partners need clarified and the

supply chain managers need more services. Supply chain and logistics managers use cloud and Wireless technologies to increase accuracy and automate supply systems to fulfil these objectives.

The automated systems are more efficient**,** faster and allow for better collection of information to be retained and checked for progress. For example, mobile devices can provide real transport surveillance wireless experiences that help supervisors expose and address operational problems.

Technology is a popular technique of automatic data-capture and identification, for instance, RFID (radiofrequency identification). Inventory RFID tags and things like clothing are affixed. These tags provide considerable potential for tracking and apply to many elements of the supply chain. This technique minimizes labor expenses by decreasing error-prone handling and streamlines the collection of data.

Additional organizations use new techniques to modernize customer delivery and to improve interactions. CRM automation provides the executive stage of chain activities which assist supervisors to detect trade inefficiencies.

Enabling direction for small carriers: Automation advantages, such as RFIDs and cloud computing are convincing, but these technical changes are challenging for big enterprises. Large companies are connected to intricate wired networks and change in new technologies is slow due to huge technological investment.

It is easier to integrate new technology successfully for small businesses with fewer investments in their current system. Operations employing relatively affordable technology, such as mobile devices, take place in small businesses. The flexibility gives small carriers an edge and enhances their flexibility and agility in the competitive environment.

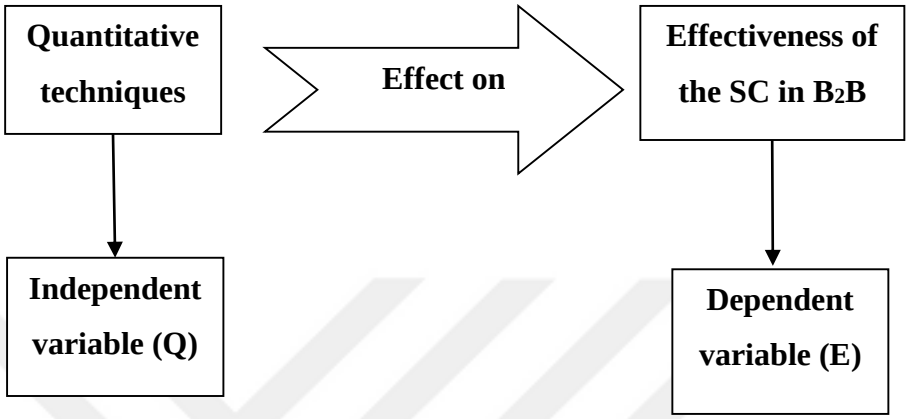
Continued and fluid communication enables companies to operate faster. In real-time communication and mobile technology, supply chain managers are better placed to develop and to unite. Operational information and enhanced communication often offer managers with an overview of day-to-day operations in all levels of the supply chain.

Unemployed or difficult to fill the needed capacity should have a strategic management of the workforce. In order to raise moral morality and improve staff productivity, flexible channels of communication are necessary in all elements of the supply chain. Increased communication and cooperation means improved customer service. Effective communication supports in product delivery and chain follow-up, and consequently high customer satisfaction. If the supply chain is linked to, employees feel better and supply chain operations are smooth.

Since, the analysis of the employment of the quantitative techniques employed in the supplying processes in B_2B receive less attention by researches and academic writings. This research will be the initiative research that highlights the impact and importance of employing quantitative techniques in the supply chains used in the B_2B.

1.4 RESEARCH FRAMEWORK

This research can be imagined to take the following framework:



This can be expressed as:

$$E = F(Q)$$

- **Q**. Is the independent variable which controls and leads the relationship with the dependent variable (E), the effectiveness of the SC in the B_2B? In other words, increasing the employment of the quantitative techniques will increase the effectiveness of SC in B_2B and V.V1, the absence or decreasing the employment of quantitative techniques will decrease the effectiveness of the SC in B_2B.

- **E**. is the dependent variable which follows the changes in the independent variable, the increases or decreases in this effectiveness is due to the increases or decreases in this effectiveness is due to the increases or decreases in the employment of the quantitative techniques.

2. LITERATURE REVIEW

2.1 SCM STRATEGIES AND ITS IMPLEMENTATION IN B2B

A great deal of misunderstanding exists over the meaning of supply chain management, despite its widespread use in academics as well as business. Habib (2010) points out that SCM is defined by some authors in operational terms, such as the flow of raw materials and products, while others define it as a management philosophy. Both SCM's management philosophy and integrated system can be viewed by Cooper and Ellram (1998). As a result, SCM requires additional investigation in order to be adequately defined.

2.1.1 Supply Chain Meaning and Importance

As previously mentioned, the term "supply chain" refers to the alignment of companies that deliver goods or services to market. A wide array of producers or suppliers, as well as transporters or warehouse operators and even customers themselves, contribute to the creation of manufactured goods. Every consumer good on the market goes through a series of transactions on the B2B trade exchange market on its route from raw material to finished product.

Buying Coke via a third party intermediary means that the product goes through numerous transactions on the B2B marketplace before it gets to the end consumer, as in buying Coke from a hypermarket or a neighbourhood store (2005). Thus, we have a supply chain at our disposal here.

In the words of Chopra and Meindl (2007), "a supply chain is made up of all parties involved in delivering a consumer request, whether they are involved directly or indirectly." The supply chain includes all functions in a business, such as a manufacturer, that are engaged in receiving and

completing a customer's request. In addition to new product creation, marketing and customer service are some of the other responsibilities that fall under this category.

According to Chen and Paulraj (2004), a typical supply chain is a network of interconnected materials, information, and service processing links with the characteristics of supply, transformation, and demand as shown in figure (2.1).

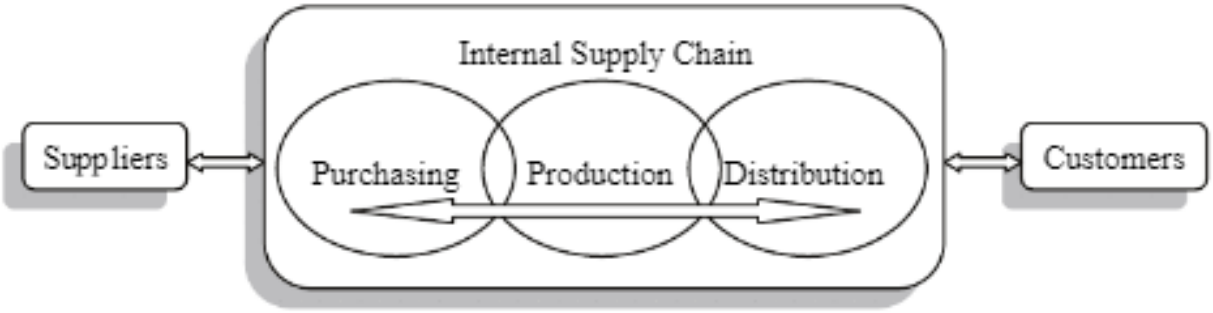


Figure 2.1: Organization's supply chain.

It's been customary for the supply chain to include steps like procuring, manufacturing, and distributing. Each of these stages may consist of a number of facilities located all over the world, depending on their location. Manufacturing industries like automotive have assembly plants located in countries other than component suppliers, and distribution occurs all over the world. Supply chains, according to Mentzer (2007). Include three or more firms (or individuals) who are directly involved in the upstream and downstream flow of goods, services, or information from a supplier to the customer.

As indicated in figure (2.2), the supply chain is divided into three levels of complexity: Direct Supply Chain, Extended Supply Chain, and Ultimate Supply Chain. The direct supply chain includes an organization, its vendors, and its customers (Figure no.2a). The extended supply chain incorporates other vendors and customers, as well as vendors who supply the immediate vendor

(Figure 2b). From the ultimate suppliers to the ultimate customers, the ultimate supply chain encompasses all companies involved in any of these processes (Figure 2c). In addition, functional intermediaries such as market research organizations, financial service providers, and logistical service providers, as well as other service providers, are included in the ultimate supply chain.

Figure 2.2: Types of channel relationships.

No matter how complicated the supply chain becomes, there is always a core entity that oversees all the activities. No of whether or not the complete supply chain is managed by this company, its existence as a commercial phenomenon continues to persist (2007). Ayers (2000) proposes that supply chains are "Life cycle processes including physical, information financial and knowledge flows whose objective is to satisfy end-user requirements by providing items and services from numerous linked suppliers."

These guidelines define the term "supply chain" as including a wide variety of operations, from sourcing to production to distribution to sales of tangible goods and services. The word "life cycle"

applies to both the market life cycle and the usage life cycle for durable goods and services. After the transaction, customer service is a critical link in the supply chain (2008).

When it comes to supply chain models, the basic rule is that there will be three types of flows: material, information, and financial. Materials include payments made to vendors, subcontractors, and vendors, as well as payments made by vendors, subcontractors, or vendors to vendors.

In many supply chains, information and financial components are just as vital as physical distribution, if not more so. In addition, the significance of knowledge inputs in supply chain activities must be emphasized. New product supply chain processes necessitate strong coordination between intellectual (design) and physical inputs (manufacturing). For this reason, (components, prototypes etc.).

The supply chain's flow direction is not limited to forward, from the first supplier to the ultimate client. Products can return up the supply chain for a variety of reasons, including repair, remanufacturing, recycling, or disposal. The reverse chain can have a substantial impact on customer happiness, recycling, and environmental conservation. Products return handling, recycling, reusing resources and garbage disposal are just a few instances of reverse logistics programs and capabilities. Goods were stimulated in the supply chain in the opposite direction (from consumer to producer) using reverse logistics strategies and skills (2012).

In conclusion, a supply chain is made up of numerous linked providers. There are numerous ways to set up a supply chain. When a small grocery store purchases veggies directly from the farmer, another is a fish cannery that buys fish from fishermen and then distributes the products through a

retail network. In the supply chain, more organizations are using coordination between suppliers, manufacturers, and distributors (2005).

From raw materials to the final consumer, everything in the supply chain is part of the process of getting goods and information from point A to point B. One way to characterize the integration of activities and processes among supply chain participants is Supply Chain Management (2007).

The field of Supply Chain Management (SCM) was formed to manage the movement of information, products, and services through a network of customers, businesses, and supply chain partners, and it has seen considerable changes and extensions since it was initially offered as a concept in the early 1980s

Several scholars believe that the roots of SCM can be traced back to the historical development of the logistics function. To carry and store commodities on their path from the original suppliers, via intermediate businesses and to end customers Waters (2012) is a good option.

Supply chain management (SCM) encompasses both traditional logistics as well as supply chain management-specific operations. While logistics deals with the transportation of materials within a single business, the term supply chain management refers to the entire network of firms that make up a supply chain. For example, supply chain management covers marketing, new product development (NPD), finance, and customer service in addition to typical logistical operations Traditionalists, re-labelling, unionists, and intersected are approaches to SCM and logistics are identified by Larsson et al. (2004) as shown in figure (2.3).

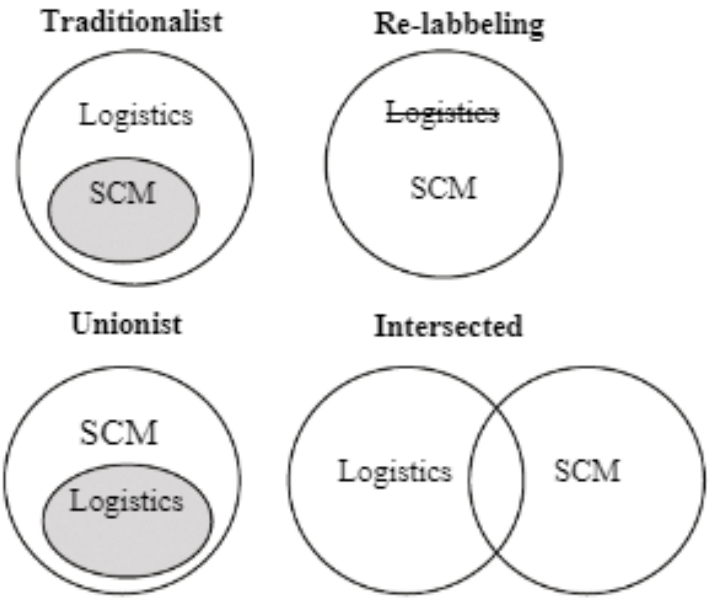


Figure 2.3: Perspectives on SCM versus logistics.

The unionist believes that logistics is a subset of SCM, and as a result, it is restricted to a certain business process or area. Operations are dealt with by logistics, strategic decisions are handled by supply chain management and tactical decisions are covered by the intersection view.

Ballou (2000) defines SCM in three dimensions: intra-functional (regarding the management of activities and processes within logistics as a company function), inter-functional coordination (regarding activities related to specific functions that are coordinated between functional areas of the company), and inter-organizational dimension (regarding the coordination of activities related to specific functions that are coordinated between functional areas (regarding the coordination of the chain of activities taking place between legally distinct companies in accordance with the flow of product). The topic of Supply Chain Management has been studied by numerous researchers and practitioners over the last 30 years as a result.

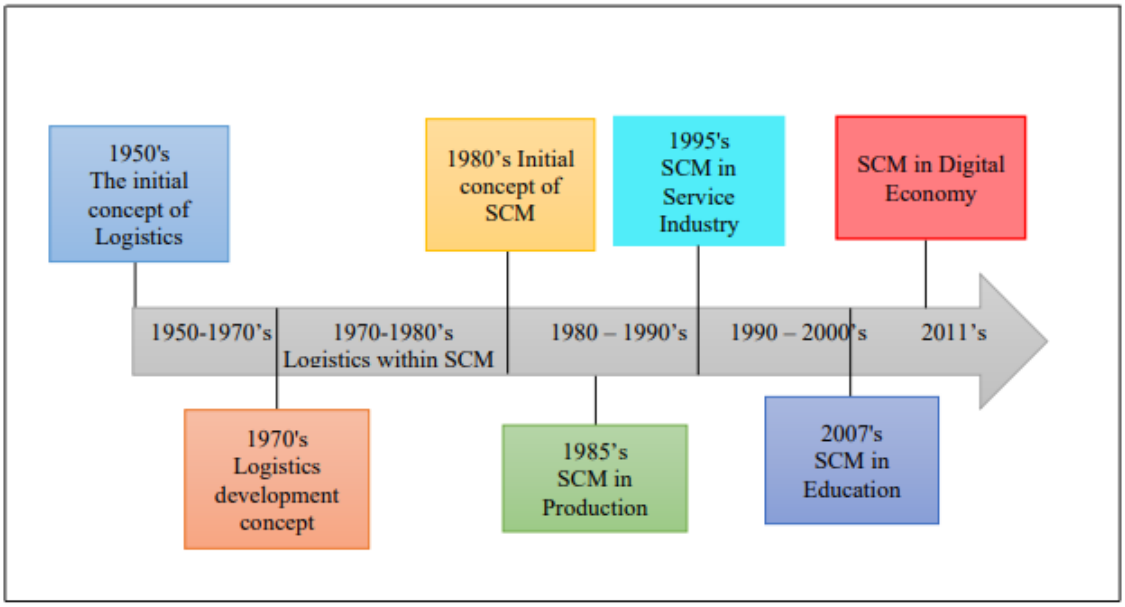


Figure 2.4: Evolutionary timeline of supply chain management

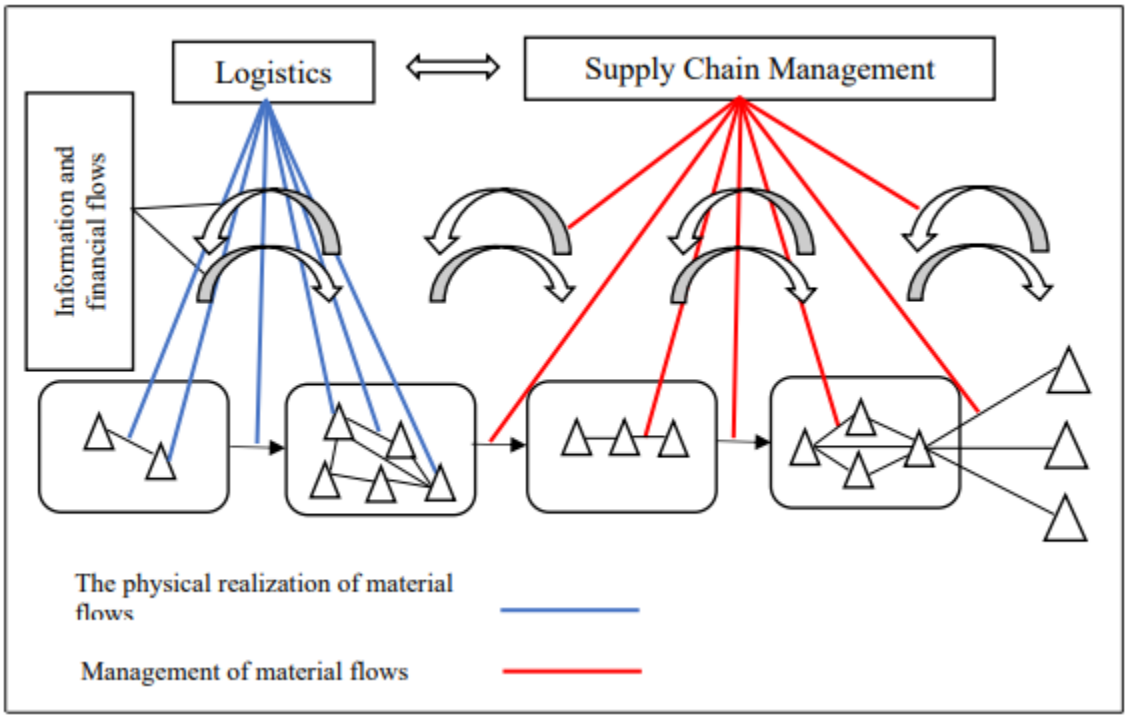


Figure 2.5: Logistics and supply chain management

The term SCM is defined by a number of key concepts and derived concepts:

- The key concepts include: planning, implementation, control, business processes, customer requirements, processing, movement, storage, point-of-origin and point-of-consumption, competitive advantage, suppliers, manufacturers, warehouses, stores, costs, service level, business function, performance, transportation, relationship, integration and logistics activities, coordination, managerial processes, collaboration, organizing and motivating, and customer value.
- In addition to the proper quantity at the right location and at the right time, operations must also be efficient in terms of raw material use, work-in-process inventory (WIP), finished goods, and data exchange.

A comprehensive review of definitions, important ideas, and derived terms revealed four major criteria: management activities; logistics; objective; and components. Using these key and derived notions, we've created a definition of SCM that's specific to each requirement (Table 2.1).

In theory, SCM is an integrated approach to an organization's operations, but in practice, it is a mashup of many disciplines, with influences from logistical management, transportation, and operations management, as well as distribution, marketing, and purchasing and IT (IT).

Table 2.1: The four major criteria of supply chain management concept

Criteria	Concepts	Definition
1. Management activities	*Key Concepts*: planning, organizing, implementing, motivating, controlling *Derived Concepts:* goods, services, efficiency	SCM consist in planning organizing, implementing, motivating and controlling efficiently of all the activities involved in movement of goods and services from the first supplier to the ultimate customer.
2. Logistics activities	*Key Concepts*: transportation, processing, storage *Derived Concepts*: raw materials, work-in-process inventory, finished goods	SCM includes transportation, processing and storage of raw materials, work-in-process inventory and finished goods from initial extraction stage to the final customer.
3. Objectives	*Key Concepts*: value, customer requirements, trust, competitive advantage, relationships *Derived Concepts:* sustainable, long term	SCM include a number of value-added processes designed to satisfy customer requirements, to establish a long term relationships, to build the trust among the supply chain partners and to achieve a sustainable competitive advantage.
4. Components	*Key Concepts*: suppliers, manufacturers, warehouses, stores *Derived Concepts:* products, services	SCM encompasses suppliers, manufacturers, warehouses, stores and other intermediaries that are involved in the movement of products and services from point-of-origin to point-of-consumption.

The majority of theoretical frameworks define SCM as the process by which all activities involved in the delivery of products are integrated and coordinated (including activities related to the procurement of inputs such as raw materials and spare parts supply; manufacturing; tracking; assembly; warehousing and inventory; order entry; order management; distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these). As a result, practitioners' definitions of Supply Chain Management tend to focus on a few specific Supply Chain Management objectives, such as increasing customer happiness and providing value to customers. Reduce costs and reaction times in diverse supply manufacturing and delivery chain activities to improve operations and profit.

2.1.2 Different Strategies of Supply Chain

Supply chain strategies are now being considered by businesses as a means of enhancing their operations and achieving long-term objectives. This supply chain method helps move and store raw materials and work-in-process inventory when it comes to final goods. Firms use these techniques to manage the integration of all supply chain activities through better supply chain partnerships in order to gain a competitive advantage (2004).

Supply chain strategies for retail play a critical part in the company's performance because of the reliance on suppliers for the finished products in the chain. Strategy has never been as critical to the success of the supply chain as it is now in today's complicated environment, where competition is no longer between firms, but rather between supply chains (2006, 2002).

Managers can better manage their retail locations with the correct supply chain strategy. Their supply chain strategy must be focused on the integration of business activities throughout the value chain to deliver optimum advantage to their end-customers (2006).

The nature of the product demand must be understood before merchants can build a supply chain strategy. Companies can then align their objectives with current market conditions and build a supply chain plan that best matches customer preferences and organizational objectives. Despite the fact that supply chain strategies are recognized as the foundation of success, little is known about the impact of supply chain strategies on retail supply chain performance. Numerous studies inspected the relationship between a company's performing and benefits and supply chain strategy, with varying degrees of success.

A study by Lee (2002) and Christopher & Towill (2001) found some supply chain strategies benefit companies directly while others (2011) found supply chain strategies don't benefit enterprises in a direct way and instead require bridging or mediating elements to achieve their aims (2011).

Supply chain strategy demonstrates how the supply chain contributes to business goals by starting with the business value offer to customers based on core capabilities and identified market winners (2017). Supply chain strategies can be classified as either agile, lean, or hybrid, according to Hines (2008) claims that supply chain strategies can be divided into two categories: those aimed at increasing efficiency, and those aimed at increasing responsiveness.

From the perspective of Vonderembse (2006), it appears that there are three types of supply chains needed to support the three product categories: standard, innovative, and hybrid.

Examples include showing that a lean distribution network should produce standard products, such as simple goods with little differentiation. In a lean supply chain, waste is reduced or eliminated at every step along the way. Nevertheless, the supply chain needs to be adaptable when it comes to cutting-edge items that utilize cutting-edge technologies. The agile supply chain is dynamic and adaptable across firms, responding quickly to market developments.

Since there are so many components and organizations in the supply chain, hybrid products may necessitate several supplier connections, a concept called hybrid supply chains. Hybrid supply networks combine lean and agile supply chains to satisfy the demands of complex products.

Agile, lean, and hybrid are the three types of supply chain techniques identified by (2002). A case study was utilized by the researchers to show how a "hybrid" or "leagile" supply chain strategy may integrate lean and agile approaches.

Decoupling is utilized by (1999) to combine the lean and agile paradigms in the supply chain. When it comes to meeting consumer demands, agility and leanness can be successfully blended in the supply chain. Information systems strategy has typically sought to improve efficiency and effectiveness in businesses (2010).

According to (2010, 1999), business strategy should be the beginning point for an information sharing plan. In other words, IT must make it easier to implement business strategy (whatever that may be) and help the organization meet its goals. The long-term business performance of the supply chain can be improved by a number of methodologies and strategies in supply chain management (2006).

SCM practices are defined as an assortment activities designed to boost supply chain efficiency (2005, 2007). Strategic supplier partnerships necessitate improved coordination between the organization and its suppliers because firms tend to have long-term relationships with value-creating suppliers.

One definition of strategic supplier partnership is an organization's relationship with its suppliers that lasts for a long time and has a major impact on each company's strategic and operational skills such that all participants benefit. In order to add value and improve supply chain performance, a strategic supplier partnership purchases goods and services from suppliers and influences their system and operational capabilities (2005, 2007).

When it comes to building long-term connections with consumers and improving customer satisfaction, customer relationship refers to the full set of processes used to handle customer complaints. Reacting swiftly to consumer needs is dependent on building strong ties with them, according to (2003).

SCM relies heavily on the exchange of information, according to (2005). In order to be effective, SCM relies on the exchange of information among participants in the supply chain (2002). By exchanging information with other supply chain partners, a firm can adapt to changing customer needs more swiftly (2006). It is referred to as supply chain integration (SCI) the extent to which all of an organization's activities, suppliers and consumers are integrated together.

Supply chain integration necessitates good communication among all parties involved (Turner, 1993). It's critical to use information properly if you want to have responsive customers. The availability of information and the reactivity of customers were discovered by (200) to be favorably connected, resulting in better business performance.

Customers' demands for a wide range of items, high quality, competitive pricing, and speedy delivery have resulted in increased flexibility. It is because of these variables that organizations must preserve their competitive advantages by making frequent design modifications and better responding to customer wants. Companies must be adaptable in order to meet changing customer needs, Aggarwal (1997).

2.1.2.1 Agile strategy

In order to meet consumer expectations, an agile supply chain strategy must be both responsive and flexible. For products with volatile demand, flexible supply networks are ideal (2017, 2003). When it comes to time compression and swift response, it's unbeatable (2003). Fisher (102) was one of the first scholars to address supply chain agility. This supply chain agility was eventually recognized as an important business-wide capacity that allows companies to respond quickly and effectively in ever-changing markets.

Agility encompasses a wide range of characteristics, including organizational structure, process, information system, and mentality, as well as flexibility and speed/responsiveness (1988). As a result, supply chain agility includes interactions with large consumers and suppliers in addition to a single firm. Some research has sought to study the relationship between supply chain flexibility and integration, such as (2009). In this research, supply chain agility was given particular attention, although there was a dearth of actual evidence.

For a supply chain to be genuinely nimble, it must have a number of defining qualities. When we say the supply chain is market-responsive, we imply it starts with an agile approach that is sensitive to market conditions. Most companies are guided by forecasts rather than by customer demand. Instead of projecting based on previous sales or shipment data and then putting these estimates into inventory, agile strategy uses data on actual client requirements to make decisions. Modern IT systems assist collect demand information directly from sales points and allow the company to hear and respond in real time to market input (1981).

Instead of having to rely on distorted and noisy information that appears when orders are conveyed from one step to another in an extensive supply chain, supply chain partners can now make decisions based on real demand data. This was made possible via EDI (Electronic Data Interchange) and the Internet (1994).

The only way to get the most out of shared information in the supply chain is through process integration. Process integration is exemplified through buyer and supplier collaboration, cooperative product creation, shared systems, and shared information. Such collaboration in the supply chain is becoming increasingly widespread as firms concentrate on controlling their core

competencies and outsource all other tasks. Companies no longer compete in a vacuum, but rather in supply networks, which are becoming increasingly obvious to the general public every day.

"Network competition" rewards firms that are better able to coordinate and manage the relationships they have within the network with their partners in order to develop closer and more agile relationships with their end customers. In today's global markets, establishing a competitive advantage requires utilizing network partners' strengths and skills to enhance supply chain performance. An agile strategy improves supply chain performance. The result is that an agile strategy significantly increases retail supply chain efficiency (1996).

2.1.2.2 Lean strategy

To achieve lean production, waste must be eliminated while focusing on "pushing" goods through the system in response to consumer demands. Retailers employ a lean strategy to cut expenses and waste. Predicting client demands and then putting together products that deliver the highest value for the least amount of money is a retailer's responsibility when using this strategy, the notion goes beyond functional strategy to include the complete supply chain strategy as a result of this holistic, company-wide approach to lean implementation. Non-value-added activities are eliminated to achieve this (2008). Chasing economies of scale and optimizing manufacturing and distribution processes to maximize capacity utilization (2003).

In order to obtain the most efficient ways of product manufacture and distribution, reduce waste in the value creation process. It is possible for store managers to anticipate customer demand in advance, which allows them to plan and produce the appropriate merchandise to meet customer needs on time. Waste and inventories have decreased, at least along the supply chain. The technique, on the other hand, increases the risk of overbuying finished items. This is a common

production strategy for mass-producing automobile parts. "Lean thinking" can help organizations cut down on waste in all of its manifestations. These operations consume resources but do not provide considerable value to the client, hence they are targeted for elimination (2005).

Every process is carried out with the least amount of resources possible, such as human labor and physical space in addition to other resources like equipment, time, and so on. It systematizes the effective flow of resources to reduce waste in order to reduce waste, cut lead times, maintain low stocks, and lower total costs. According to Townsend, every business wastes at least half of its resources, including people, effort, physical space, and money. Most retail supply chains have waste in the following areas:

- The products' quality is so low that they can't meet client expectations. Extra storage space is a waste.
- A poor procedure is one that is overly complicated or time-consuming.
- A lot of waiting is involved, whether it's for finished goods or materials to arrive or for equipment to be fixed.
- Holding an excessive amount of inventory increases complexity and expenses.

Waste can be eliminated in a variety of ways with a lean strategy. Retailers can increase the efficiency of their supply chains by eliminating wasteful operations, streamlining motions, lowering unneeded inventory, and leveraging higher technology. They can also look for economies of scale and locate stores close to customers (2017).

2.1.2.3 Hybrid strategy

Lean and agile supply chains may be combined in some circumstances by enterprises Towill, (2002). Leagile supply chains, on the other hand, combine lean and agile techniques to supply chain management to maximize efficiency.

There are several ways to integrate lean and agile methodologies in a hybrid strategy: Agile manufacturing requires a flexible production capacity to meet unusual demand or unexpected requirements; use of postponement strategies, in which "platform" products are forecast and then final assembly and configuration is done on customer order, whereas lean manufacturing is compatible with high volume and stable demand items..

Table 2.2: Lean and agile characteristics

	Characteristics	
	Lean	***Agile***
focus	efficiency	effectiveness & flexibility
measures	productivity & cost	abiliaty to supply & customer satisfaction
impulse	forecast-driven	customer-order- and market-driven
product life cycle	short	long
product and process variety	low	high
product type	functional	innovative
focus decreasing lead time	...without having cost-impacts	…without having flexibility-impact
contribution margin	low	high
supply uncertainty	low	high
demand uncertainty	low	high

Supply chains can quickly reconfigure strategic inventory once actual demand is known by keeping it in a generic or unfinished form at the decoupling point. Using a hybrid strategy, you follow lean principles up to the point when you decouple from the agile processes, then develop an agile response on top of that. If a company wants to enhance its performance, it should use cost-effective tactics and operate in a low-cost area. Organizations that wish to be innovative and competitive should, on the other hand, utilize tactics that are more closely connected with the

supply chain's agility (ASC). Empirical research reveals that the goal of a lean supply chain is to reduce costs wherever possible.

Researchers have discovered that only by aligning the supply chain strategy with process or product requests can returns from supply chain investments be realized. Consumers who want functional products with predictable market demand should be served by efficient (or lean) supply chains, whereas customers who want creative products should be served by responsive (or agile) supply chains Christopher, (1994).

2.1.3 The Effect of Supply Chain on the Performance Improvement of B2B Businesses

When developing a supply chain evaluation model, model accuracy is crucial. To make sure the model does what it is supposed to, every stage of construction and every model function must be properly examined. Measurement of performance and measurement of efficiency are not the same thing (performance assesses output, while efficiency assesses the method in which output is achieved). However, both performance and efficiency measures can be used simultaneously to assess the Supply Chain's success.

According to Agami (2012), performance metrics provide as a basis for comparing different options. Measurements of performance provide a wealth of general information that may be utilized for strategic decision-making and to guarantee that the company maintains a strong position in the marketplace. (2015) argues that feedback is critical to the success of any procedure. An excellent Supply Chain Performance Measurement System can assist govern business processes (SCPMS). Due to the input we receive, it is possible to compare current progress with planned or budgeted values, simplify benchmarking with manufacturing best practices and identify areas of development.

Because of performance measurement, employees must be motivated and rewarded for their hard work. Performance should be measured to encourage personnel to strive for excellence and to find the weak links in the supply chain when analyzing results.

<u>These are the objectives of a performance system:</u>

- Making decisions requires the system to show where and how to operate, as well as control the effects of completed action plans.

- Strategic plans should be controlled by the system so that changes can be made to ensure long-term success.

- To achieve internal objectives as well as the demands of many external stakeholders, it is critical to track performance.

- The system's analytic capabilities are required to detect a drop in business performance.

- Continual improvement relies heavily on measuring performance.

- Measuring progress is critical for any process of improvement because it helps to validate more efforts.

- When analyzing performance, it's critical to compare and find performance apertures.

- All corporate activities must be documented so that suppliers and customers can access them upon request. Suppliers can learn about their improvement procedures by looking at their past performance.

For a supply chain to work, suppliers and buyers of commodities travelling through it must communicate with one another. Those elements are connected in a cause-and-effect manner. To maximize the value of each component and help raise the value of co-components in the Supply Chain at the same time, there should be a high level of integration between components.

The performance of all components in the Supply Chain is harmed when there is a bad link somewhere along the line. The efficiency of each component must be monitored to assess the overall Supply Chain's performance. We need a way to monitor supply chain performance across all connections if we want it to become more efficient. This creates a hurdle in assessing Supply

Chain efficiency since only by measuring the efficiency of transactions collectively along the full supply chain can the efficiency of Supply Chain be assessed. As a result, selecting an evaluation model for Supply Chain efficiency that incorporates all relevant transactions is critical (2006).

Supply Chain efficiency assessment has been hampered further by (1991), who point out that efficiency assessments aren't usually used fairly across the organization. Erroneous supply chain efficiency measurements may result from placing too much emphasis on a particular metric. Little (1991) claims that this risk increases in the absence of a centralized body in charge of overseeing the entire Supply Chain. Since each link in the Supply Chain affects the Supply Chain's efficiency when a new technology is implemented, each link must be evaluated.

It has been found that companies succeed when they satisfy their customers faster and better than their competitors, according to Kotler's research (1991). A complete supply chain's effectiveness and efficiency can be assessed, which benefits businesses.

Every product that a company sells has its own Supply Chain. As stated by (1994), the Supply Chains of various industries have unique characteristics. As a result, the supply chain should be customized for each company's unique production and business needs. In order to thoroughly examine the connections, it is critical that all service providers in a Supply Chain use the same method for evaluating efficiency. A model that can be applied across the entire supply chain must be used to evaluate the efficiency of the Supply Chain.

When evaluating the efficiency of the Supply Chain, it's also necessary to look at how it was constructed. The performance of supply chains optimized for network speed may suffer if responsiveness, flexibility, and measurability are not implemented from the start. As a result, Supply Chains must be carefully planned. In the opinion of, it's critical to be clear about what

information the metric is looking at when measuring efficiency. In the vast majority of cases, only numerical measurements are employed.

Lambert (2001) says evaluating supply chain efficiency can be difficult due to the lack of a generally agreed-upon definition of supply chain management and the complications associated with overlapping supply chains. The lack of Supply Chain orientation, the difficulty of gathering assessments across numerous links, the reluctance of enterprises to exchange information, and the inability to capture product, customer, and supply chain performance are all complicating concerns. Additional challenges include: Lack of a process for generating these measures is another reason for their scarcity.

2.2 THE QUANTITATIVE TECHNIQUES USED IN SC

Quantitative techniques are important in Supply Chain Optimization, or QSC for short, because it is a broad approach to supply chains that, simply put, aims to maximize human intelligence while exploiting the capabilities of modern computational systems. This point of view, however, is not exhaustive. It does not pretend to be the be-all and end-all solution to supply chain difficulties, but rather one of numerous complementary ways that can be used practically every time to enhance the situation. Brandenburg (2014).

2.2.1 Quantitative Techniques Meaning and Importance

Quantitative techniques help the company improve service quality, reduce excess stocks and write-offs, increase productivity, and lower buy prices and operating costs, and so on. Supply chain issues might vary greatly depending on the situation. Quantitative Supply Chain aims to embrace this diversity while also coping with the complexities that come with it. Quantitative Supply Chain, on the other hand, may be baffling to supply chain practitioners who are used to more traditional supply chain optimization methodologies. Brandenburg (2014).

A supply chain, with the exception of very tiny businesses, involves millions of decisions per day. Every day, the corporation makes the decision to maintain a unit in stock rather than shift it somewhere else. Furthermore, the same rationale applies to stock items that have never been made or purchased, Brandenburg (2014).

With quantitative supply chain, the goal is to make as many decisions as possible, and computers play a key role in this process. In the late 1970s, one of the first firm functions to be digitalized

was supply chains, which is why this isn't surprising. On the other hand, Quantitative Supply Chain focuses on advancing digitization, Brandenburg (2014).

We have to admit that the "future supply chain system" has been implemented multiple times incorrectly over the past two decades. As a result of the combination of black-box effects and botched automation, these technologies have caused numerous errors in supply chains that can no longer be remedied by human intervention, Tayur (2012).

As a result of these mistakes, Quantitative Supply Chain was created in part: rather than relying on software to know a company better than its own managers, the emphasis should be on implementing the insights given by management but with increased dependability and clarity. Although software technology can be a strong enabler if used effectively, the option of completely removing people from the solution isn't one that is practical at this time, Tayur (2012).

If the company wants to achieve this goal, it will need different software for tracking its products, resources (such as materials), and other resources than what it needs to make better judgments. All of these software, whether it's an ERP, a WMS, an MRP, or an OMS, is primarily concerned with managing the company's processes and data entry stream. There are numerous benefits to streamlining data entry and automating all clerical tasks. These responsibilities do not even begin to address the core issue of expanding an organization's capacity to implement human insights at scale, as required by its supply chain. Tayur (2012) However, this remains the case.

Then there will be no optimization if no measurements are made. As a result, Quantitative Supply Chain is all about numbers and measures, as the name implies. acts in the supply chain - for example, purchasing inventory or transferring inventory - have consequences and should be assessed from a strong financial (in dollars, for example) viewpoint. With good metrics you don't

have to put in as much of an effort. With Quantitative Supply Chain, the business will be assisted in generating such indicators, which are critical in calculating the overall return on investment (ROI) of the supply chain initiative.

Finally, as previously indicated, Quantitative Supply Chain is not a comprehensive framework. No ambition to fix or improve the entire supply chain is present. As far as finding reliable suppliers or logistic partners is concerned, it makes no guarantees. It doesn't claim to make it easier to find and retain talented employees. While Quantitative Supply Chain has a specific focus, it is fully capable of providing tangible results.

2.2.2 Quantitative Techniques Used in SC Strategies

Quantitative Supply Chain uses a minimum of human resources, even when working with very vast supply networks. To be successful, such a project will require specialized resources, which we will go over more thoroughly later on. Quantitative Supply Chain begins with a fundamental premise: the business should make the most of every human connection Tucker (2011). Before diving into the various roles and their complexities, let's start with that.

Traditionally, supply chain solutions consume human efforts rather than monetizing them. This idea goes against that. An infinite stream of manual entries is required to keep the solution running, which in turn involves making an endless number of judgments. For example, seasonal profiles can be adjusted, exceptions and alarms can be responded to, and unexpected prediction results can be resolved, and so on.

This is something that Quantitative Supply Chain wants to change. Supply chain expertise paired with acute business insights are far too precious and important to be squandered on boring tasks alone. Human labor is expensive, of course. To avoid manual involvement, focus on the underlying problem. If predicted values are off, modifying the input data or the forecasting algorithm won't help. Fixing symptoms only makes things worse because you'll be dealing with the same problems forever, Simchi (2004).

An organization's scale determines how large a quantitative supply chain implementation team is need to be. At the low end of the scale, it can be less than an FTE (full-time employee), frequently for companies with annual revenue of less than $20 million. It can have up to a dozen people working on it, but the inventory at stake is worth several billion dollars, Simchi (2004).

Quantitative Supply Chain software technologies have been a tad vague up until now. However, the Quantitative Supply Chain technology stack is critical. It is theoretically possible to rewrite every piece of software from the ground up, but in practice, the Supply Chain Scientist needs a lot of help from his stack just to get by. Furthermore, capabilities such as forecasting and numerical optimization necessitate years of preceding R&D and go well beyond what the Supply Chain Scientist can provide during the program, Simchi (2004).

One of the most important pre-requisites for Quantitative Supply Chain is the availability of a data platform with programmable capabilities, and having such a platform available is clearly a benefit. In other words, we're talking about a data platform because while any desktop workstation today can store multiple terabytes, that doesn't mean it has any other desirable properties for implementing the initiative, such as hardware reliability, auditability for all accesses, data export

compatibility, etc. Data platforms should be able to process vast amounts of data in a short period of time because supply chain datasets are often enormous, Tucker (2011).

The data platform must be able to implement and execute nearly any data processing logic, which means it must have programmatic capabilities. Such functions are implemented through the usage of a programming language. Most people associate programming with high-level technical skills, and vendors often prey on consumers' fears of having to deal with solutions that need "programming" by providing them with simple interfaces comprised of buttons and drop-down lists. It is precisely because Excel has programmatic capabilities, including the capacity to write arbitrary complex formulas that supply chain teams are forbidden from using programmatic capabilities. Having programmatic abilities is a need, not a frill.

Finally, there are other advantages to using a supply chain-specific data platform. Quantitative trading, as used by banks and funds, has comparable requirements to supply chain and, therefore, also necessitates the use of a data platform. Supply chain choices, in contrast to high-frequency trading, don't demand a sub-millisecond latency. Engineering tradeoffs and a software ecosystem combine to produce a data platform's design. This starts with the supported data types. Supply chain challenges should be met with software ecosystem and engineering tradeoffs, Tucker (2011).

Quantitative Supply Chain requires a probabilistic forecasting engine as the second prerequisite. A probability will be assigned to each possible future situation by this program. Because it goes against conventional wisdom to predict the future, this type of forecast may seem alarming at first. However, the "catch" is really in the uncertainty: there are no guarantees in life. A forecast that was supposed to be accurate but isn't because of the standard forecasting perspective's denial of

uncertainty and unpredictability. A probabilistic forecasting engine uses probability to solve the problem directly, Tucker (2011).

Probabilistic forecasting is frequently a two-stage process in the supply chain, starting with a lead time projection and concluding with a demand forecast. It's a probabilistic forecast in which all possible lead times are given a probability, usually expressed in days. Additionally, demand forecasts are probabilistic projections that are based on inputs such as lead time forecasts. Because lead times are inherently variable, the demand forecast's time frame must match, Branden (2014).

There is substantially more data in the output of the probabilistic forecasting engine since it generates sets of probability distributions rather than standard forecasts. The problem isn't that the forecasting engine is blocking the data platform, but that a high level of collaboration is required to avoid encountering too much friction when processing a big number of possibilities, Brandenburg (2014).

2.2.3 The Effect of Quantitative Techniques on the Performance Improvement of SC

Software engineering research and development, as well as data science best practices, have a substantial impact on Quantitative Supply Chain. With a focus on agility and the ability to recover from unforeseen issues and/results, the process is very iterative. As a result, organizations who aren't substantially involved in the software industry find this behavior startling:

- The first phase is scoping, and it identifies which supply chain decisions will be addressed by the project. A decision-making process's expected complexity and the data it will require are determined in this phase.

- The data preparation stage is the next phase. Building an automated system that transfers all relevant data from enterprise systems to a separate analytical platform is what this involves. Additionally, it calls for compiling and organizing this data for quantitative evaluation.

- The pilot phase, which is the third phase, involves implementing an initial decision-making logic that provides decisions, such as suggested purchase quantities, that outperform the company's previous procedures. This reasoning should be automated to the fullest extent possible.

- The production phase gets the initiative to cruising speed, where performance is evaluated and maintained and a consensus is achieved on the necessary level of refinement for the supply chain models themselves.

The easiest part of the project is the scoping phase, which identifies the general issues the Quantitative Supply Chain will address. These decisions may be subject to numerous restrictions, such as MOQ (minimum order quantities), full containers, the maximum warehousing capacity, and so on. These limitations need to be carefully examined. These economic forces should be explored, as they have a significant impact on decision making. Finally, it is necessary to identify the relevant historical data and the systems from which the data will be gathered.

When it comes to data preparation, it's both time consuming and fraught with danger. The complexity of obtaining and making meaning of data is frequently underestimated. For the business to function, operational systems were developed (e.g., ERP, WMS, and OMS). Historical data is a byproduct of the installation of these systems, rather than their primary objective of recording data. As a result, there will be numerous obstacles to overcome throughout this stage. Whenever a problem arises, the majority of companies make the error to back up and write up a detailed specification. A specification, on the other hand, can only deal with difficulties that are already well-known or anticipated. Although this is the case, nearly all of the major issues that develop during this phase are completely out of the blue.

Problems are rarely discovered until after someone begins to use data-driven decision-making to put it to the test. A problem with the data is almost often the result of wrong judgments notwithstanding solid reasoning. A company's ability to control its own data can be tested using data-driven decisions, which are sensitive to flaws with data. The data is also tested in a way that benefits the company with this technique, as well. To give something of value to the business, data quality and data comprehension are just means. Constantly looking for ways to improve data-driven decisions is a smart move.

It's during the pilot stage that supply chain management is really put through its paces. It may seem counterintuitive to use probabilistic forecasts in the face of uncertainty. For the same reason, many traditional methods like as weekly or monthly forecasts, safety stocks, stock covers and stock alerts actually do more harm than good. This is not to say the Quantitative Supply Chain project should be left to its own devices, however. In reality, Quantitative Supply Chain is all about quantifying performance, not the other way around. Instead of resolving issues, many traditional supply chain procedures define them as obstacles that must be overcome. Supply chain leadership faces an uphill battle during the pilot phase because they must remain open-minded and refrain from reintroducing into the project features that could lead to inefficiencies later on. You can't support a cause and despise the outcome.

It is therefore time to put the Supply Chain Scientist and his or her technology to the test, as the reasoning must be executed quickly enough to generate decisions. The initial objective is to provide results that practitioners believe are reasonable and don't need to be manually modified. We advise you to not underestimate the challenge of producing "sound" automated decisions automatically. Because of this, traditional supply chain systems require a large number of manual modifications to keep running smoothly. There is a new rule introduced by Quantitative Supply Chain: no manual entries are allowed for normal processes. All variables must now become part of a logical equation.

All necessary aspects, methods, and facts should be collected by the Supply Chain Coordinator before the decision-making process can begin. After that, the Supply Chain Scientist puts in place the first set of KPIs that are tied to the decisions. In order to avoid black-box effects, these KPIs were developed using complicated numerical approaches. It is the responsibility of the Supply Chain Leader to ensure that the KPIs are aligned with the company's objectives.

During the development phase, the project is stabilized and brought up to speed. We utilize reasoning to make decisions, and we keep a careful eye on the outcomes. A few weeks to a few months are frequently required to evaluate the impact of any supply chain action. As a result, the manufacturing phase of the project moves more slowly, allowing for more accurate evaluations of the automated decision-making process. The project is currently moving into a stage where it will continue to improve. In spite of the fact that new improvements are always welcome, it is necessary to strike a balance between the advantages of possible logical enhancements and the accompanying complexity of those improvements in order for the overall system to remain manageable

As a result, the Supply Chain Coordinator is now free to focus on the strategic insights provided by supply chain management. During the pilot phase, any useful supply chain process adjustments may have been put on hold to avoid disrupting operations by making all of them at once. In any case, with a decreased change rate in the logic of decision-making comes the possibility of altering procedures gradually in order to gain performance gains that go beyond better regular decision-making.

By focusing more and more on KPIs and data quality, the Supply Chain Scientist fine-tunes their reasoning. Furthermore, he's in charge of making adjustments to the logic if minor flaws or limitations, usually linked to sporadic events, are found over time. As processes evolve, the rationale used to make decisions must be adjusted to keep pace with the changes. The Supply Chain Scientist must ensure that the rationale of decision-making remains current in this ever-changing environment even if internal procedures do not alter.

2.3 PREVIOUS STUDIES

- The study of Trent Randolph tucker (2012)

This study aimed to improve the concept of supply chain orientation and this was done through three stages; determining additional SCO (supply chain orientation) factors/ indicators beyond those already in existence, and refining the total group of variables/ measures through factor analysis techniques beside the SCO concept to the other SCM - related concepts. The study concluded that SCO was a vital theory that can be used to build SCM and this may be tied with the physical and mechanic capabilities of the giant suppliers. So, the study indicated that SCO affected greatly the SCOP of the business. In the US, the cost of SCM especially, the business logistics were in 2009 only was 1.3 trillion dollars which impose that professional should allocate adequate interests for clear understanding of SCM, its components and mechanisms.

- The study of Lonel et al.(2009)

The study aimed to combine the concept of marketing within the SC activities and operations to close the relationships between the suppliers as a business partner and the consumers. This study was executed through interviews with 60 organizations in the roman's markets to determine and define the way that businesses through B2B markets can merge or integrate the supply chain with the strategic marketing concepts.

- The study of Shamas (2005)

The study aimed to search how AI can enhance the performance and operations of SC. This was done through imitating the experiment of Amazon as it used AI to provide its clients and customers with superior products and services. Similarly, Amer sports used AI and machine learning effectively and successfully to improve either the predictability or management of its SC. The study depended on document analysis and 20 electronic documents were evaluated. The study

concluded that AI can easily improve, directs, increase the accuracy and speed of SC activities and transactions.

- The study of Lahkani et al. (2020)

The study aimed to determine how the various electronic applications used in SC and electronic commerce can improve the logistics operations and the efficiency and effectiveness of the SC employed in B2B businesses as a way to improve all the electronic activities and transactions (B2C also), the study indicated that using block chain can improve the efficiency of logistics services and digital documentation which reached to 74 & 75% respectively and the unique advantage of block chain was the security of the data base built and its speed which not only improve the logistic overall services but satisfy the requirements of sustainability.

- The study of Seyd Mohsen et al. (2019)

The study focused on the ability of SC to cope and fight the various fluctuations in the market which represents SCR (supply chain resilience and how the various supply chain networks can capable to with stand, cope and recover from the expected or potential disruptions to satisfy both, the needs and expectations of consumers of the business and enable the business to achieve reasonable profits. The study concluded that through the surveys analyzed that as the supply chain resilience improved and supported with the continuous training and development in the capability of the professionals, the success opportunities will have increased and business can achieve superior performance.

- The study of Scott (2015)

The study refered to the total inventoriable items in US with 1.7 trillion US. This may represent an opportunity for the American manufactures to decrease the costs when adequate interests allocated to SC and minimize the unnecessary costs, spoilage or salvage. The study was done through executing 16 interviews with professionals and managers whom responsible for determining and executing of inventory control strategies. The study focuses on four themes that can describe inventory control policies as:

- Economic order quantity
- Kanban
- Vendor management inventory
- Process integration

The study concluded that all the existing strategies employed in SC can be continuously improved and enhanced through the continuous training and development of the managers and employees in the logistics and related departments and functions which can decrease spoilages salvages and scraps which in turn can improve the overall profitability & performance of the firm.

3. METHODOLOGY

3.1 RESEARCH DESIGN

An explanatory qualitative research that seeks to investigate the nature of the relationship between the qualitative techniques employed in B2B and their effectiveness in the Supply Chain (SC). The research depends on the analysis of the quantitative data collected from the businesses that work in B2B to analyze and assess how the employing of the quantitative techniques can participate significantly in increasing the performance and effectiveness of SC.

This research depended mainly on two types of data:

- **Primary data**; which was required to construct the practical part of this study and these data was collected through interview that was designed and directed toward the managers of materials and parts of B2B businesses and other professionals.

- **Secondary data**; which was needed to construct or build the theoretical body of this research. This data was collected through the various academic articles & journals, books, the online data published about the firms that implement the quantitative techniques and their impact on its Supply chain management (SCM).

3.2 DATA COLLECTION AND ANALYSIS

Data was collected through interviews with 10 managers of materials and parts of B2B businesses and other professionals within an organization in the Iraqi's markets to determine and define the way that businesses through B2B markets can merge or integrate the supply chain management with the quantitative techniques to measure the effectiveness of them in improving the performance of the organization.

4. RESULTS AND DISCUSSION

Our findings suggest that quantitative techniques are critical for a corporation regardless of the Supply Chain Strategies (SCS) it employs. According to Kang and Moon, enterprises should apply alternative tactics (quantitative techniques) in the supply chain to complement their missing capabilities, as it is impossible to gain a competitive edge in all sectors with limited resources. As a result, for effective management, they should concentrate on their core competencies.

As previously said, a B2B supply chain strategy is required to improve performance and, in the long run, to develop their skills. We developed the following hypotheses as a result of these reasoning:

H_0 .. There is a significant positive relationship between the implementation of the quantitative techniques and the effectiveness of SC strategies employed in B_2B.

H_1 .. There is a significant positive relationship between the implementation of the quantitative techniques and the enhancement in revenues, and performance in B_2B.

Quantitative techniques were confirmed to have a significant effect on the effectiveness of SC strategies employed in B_2B. Moreover, Quantitative techniques were shown to have a significant effect on the enhancement in revenues, and performance in B_2B as found in the final path model. These results support hypotheses H_0 and H_1 as follows:

Table 4.1: Final path analysis

Path			B	β	SE	CR	ρ	Hypothesis supported/ rejected
H_0	Quantitative techniques	Effectiveness of SC	-0.004	-0.007	0.055	-0.079	0.037	Supported
H_1	Quantitative techniques	Enhancement in revenues, and performance	0.015	0.022	0.060	0.248	0.004	Supported

B is regression weights, β is the standardized regression weight, SE is the standard error, CR is the critical ration, and ρ is the probability. *** $\rho<0.001$.

The path coefficient of H_0 (Quantitative techniques will have a positive effect on the effectiveness of SC strategies employed in B_2B) was -0.007 (CR= -0.079, ρ= 0.037) for the effectiveness of SC. The path coefficient of H_1 (Quantitative techniques will have a positive effect on the enhancement in revenues, and performance in B_2B) was 0.015 (CR= 0.248, ρ= 0.0.004) for the enhancement in revenues, and performance, supporting H_0 and H_1.

According to the competencies of the organization, quantitative techniques have a direct impact on supply chain strategy and ultimately on overall business performance such as quality and cost as well as delivery as well as flexibility. When an organization has strong capabilities in research, commercialization of new technology, and marketing, supply chain tactics can help it perform better overall. By cutting costs while simultaneously enhancing quality and delivery performance, quantitative techniques can help businesses function better by optimizing the organizational competencies of each company. Consequently, quantitative techniques can improve the performance of the business.

Surprisingly, a lean SCS prioritizes external integration over internal integration. Such an externally focused organization meets the needs of a lean supply chain in terms of supplier development, source quality, information interchange, and JIT delivery/purchase (2011).

We've realized that a flexible SCS requires equal integration from within and without. Interestingly, this structure resembles (2009) balanced supply chain, which suggests that companies must integrate both internally and outside to achieve the best results. An agile SCS emphasizes a flexible and customizable SCS that responds to the needs of the customer. In order to achieve this, it is necessary to coordinate internal activities among multiple departments and to be flexible as things change. As a result, agile supply chain systems pay greater attention than lean supply chain systems to the overall balance of the supply chain process flow. Another finding is that a flexible supply chain necessitates less external integration than a lean one. Iraqi firms' unfamiliarity with and difficulty establishing agile SCSs with supply chain partners could be a starting point. The dynamic supply chain structure required by agile SCSs appears to be in place in Iraq, based on our field observations. When faced with market instability, SCSs outperform investments in integration at making firms adaptive.

Iraq's growing economy relies more on informal control methods like integration than on formal control systems (2014). SCSs are less likely to focus on external integration when they are agile. Moreover, this finding is in keeping with previous findings and accepted wisdom. A flexible supply chain is one that can be quickly reconfigured while still maintaining high levels of efficiency (2004). Agile supply chains, as opposed to lean supply chains, demand a short-term and flexible relationship with suppliers to rearrange the supply chain structure and grasp transitory market opportunities.

Flexible logistics should be the focus of an agile supply chain, according to (1999). Manufacturers who have an agile SCS should look into different supplier and logistics network choices to ensure rapid reaction to tailored demand and supply chain interruption due to uncertainties. Developing a rigid link with its partners is incompatible with criteria for high external integration from the aspect of transaction cost economics.

Instead of encouraging enterprises to invest disproportionately in external integration, an agile supply chain prevents them from becoming "locked in" with their supply chain partners. Agile supply chains are ruled by constant change, and companies in such a chain incur significant costs to exchange real-time information about changes and coordinate their activities as those changes take place. Financial performance has a positive relationship with internal integration, as one might predict. Unfortunately, contrary to our expectations, there is no significant link between external integration and financial performance, possibly because other variables reduce or moderate the relationship

Supplier and customer integration has an indirect impact on financial performance via supplier and customer-oriented operational performance, as Huo (2012) discovers. Integrated supply chains improve financial performance by providing better customer service, according to (2012). When customers are integrated, financial performance is improved because customer happiness is moderated. This conclusion is also based on the fact that supplier and customer integration has a nonlinear impact on financial performance, as per (2012).

The other argument could be that external integration requires a number of investments, including information technology (IT), human resources (HR), and money (money and time), all of which reduce the financial benefits of external integration. Consumer involvement, according to [146],

transfers more power from the focal firm to its customers while also increasing the workload of the focal company. According to the research, there is no significant link between external integration and financial performance.

Iraq's financial performance may be explained by links with supply chain partners rather than by formal external integration. Iraq is a developing country, and this makes it difficult to significantly improve financial performance in a developed country like the United States. Our findings add to the body of knowledge about the relationship between SCI and performance, especially in emerging markets like Iraq.

Multi-objective optimizations with primary objectives such as minimizing total SC costs (e.g., sum of supplier evaluation costs, transportation expenses), as well as secondary objectives like increasing SC resilience or reducing recovery times for disrupted SC components, may be explored in future research efforts. This is based on an analysis of optimization model SCs.

Future models are likely to concentrate on the development of multi-objective, two-stage stochastic programming, with some decisions made in the first stage, prior to disruption, such as; I who are the selected suppliers; (ii) how much surplus inventory should a selected supplier have prior to disruption; and (iii) how many products should be transported from a selected supplier.

Stage two should determine decision variables dependent on the disruption scenario and determined after the interruption occurs, such as I backup supplier selection; (ii) customer demand proportion that can be met by backup supplier due to disruption at the primary supplier; and (iii) restored primary supplier restoration capacity. These variables are dependent on the disruption scenario and are determined after the interruption occurs. Decision variables can, of course, be separated based on the SC's structure and components.

5. CONCLUSION

New supply chain management methodologies and innovative information technology approaches for e-commerce management are required because of the considerable penetration of suppliers required to restructure the economy. Having supply chain in international B2B e-commerce makes sense from an efficiency aspect as digital economy grows, as it improves organizational procedures and competitiveness of companies in the industry. However, it has been found that supply chain improves e-commerce profitability for B2B market firms by enhancing logistical and digital documentation maintenance efficiency.

Because of the findings, electronic reporting will be more transparent going forward, which will simplify supply chain financing. Further research could focus on the e-commerce platform financial ecosystem in order to improve the competitiveness of companies and the satisfaction of customers. The integration of supply chain finance and logistics platforms provides efficient data interchange between all transactions participants.

IMPLICATIONS FOR ACADEMIA AND PRACTICE:

A future information infrastructure based on the Internet of Things, data analytics, artificial intelligence, and other new and developing technologies will be formed as the supply chain network expands and quantitative supply chain approaches are actively introduced into the corporate world. Encouraging supply chains and their financial support to be more transparent, traceable, and secure may prove pivotal in the development of more sustainable economies. In order to implement quantitative supply chain strategies into the operations of top firms in certain niches and industries, it is necessary to make precise calculations.

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APPENDIX A

MARKETING STRATEGIES INTERVIEW

This semi-structured interview questions were created by the researcher based on the literature. The interview questions consisted of open-ended questions to determine the problematic areas of using different marketing strategies by the selected managers of materials and parts of B2B businesses and other professionals. A total of 10 participants were selected for the interview; each interview was roughly done between 10–15 minutes. The interview questions included the following:

1. How do you measure marketing?

2. What metrics do you use to measure the marketing performance?

3. What is the best attribution model?

4. What's the difference between attribution data and conversion data?

5. How is it possible to track offline marketing?