International Journal of Scientific Research in Engineering and Management (IJSREM)

Volume: 04 Issue: 11 | Nov -2020 ISSN: 2582-3930

# Strategic Study of Supply Chain Management

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*Abstract*

*A supply chain is the connected network of individuals, organizations, resources, activities, and technologies involved in the manufacture and sale of a product or service. A supply chain starts with the delivery of raw materials from a supplier to a manufacturer and ends with the delivery of the finished product or service to the end consumer.Supply chain management is the management of the flow of goods and services and includes all processes that transform raw materials into final products. It involves the active of a business's supply-side activities to maximize customer value and gain a competitive advantage in the marketplace.SCM represents an effort by suppliers to develop and implement supply chains that are as efficient and economical as possible. Supply chains cover everything from production to product development to the information systems needed to direct these undertakings.We have captured various definitions of SCM provided byexperts from the initial to recent period along with major classical definitions.Various dimensions of Supply chain are an integral part of this study. Thepaper discusses SCM and its dimensions; and tries to delineate SCM fromrelated areas like Logistics Management, Value Chain Management andOperations Management. The paper also elaborates various theories of SCM.On completion of thorough literature review, the paper ends with a conclusionand future scope of work.*

## 1. Introduction

A supply chain involves a series of steps involved to get a product or service to the customer. The steps include moving and transforming raw materials into finished products, transporting those products, and distributing them to the end-user. The entities involved in the supply chain include producers, vendors, warehouses, transportation companies, distribution centers, and retailers.

Key Points to note:

- A supply chain is a network between a company and its suppliers to produce and distribute a specific product or service.
- The entities in the supply chain include producers, vendors, warehouses, transportation companies, distribution centers, and retailers.
- The functions in a supply chain include product development, marketing, operations, distribution, finance, and customer service.
- Supply chain management results in lower costs and a faster production cycle.
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The elements of a supply chain include all the functions that start with receiving an order to meeting the customer's request. These functions include product development, marketing, operations, distribution networks, finance, and customer service.

Supply chain management is a very important part of the business process. There are many different links in this chain that require skill and expertise. When supply chain management is effective, it can lower a company's overall costs and boost profitability. If one link breaks down, it can affect the rest of the chain and can be costly.

## 2. Supply Chain

### 2.1 Supply Chain Management vs. Business Logistics Management

The terms supply chain management and business logistics management—or simply, logistics—are often used interchangeably. Logistics, which is one link in the supply chain, is different.

Logistics refers specifically to the part of the supply chain that deals with the planning and control of the movement and storage of goods and services from their point of origin to their final destination.

Logistics management begins with the raw materials and ends with the delivery of the final product.

Successful logistics management ensures that there is no delay in delivery at any point in the chain and that products and services are delivered in good condition. This, in turn, helps keep the company's costs down.

**2.2 How the Flow of Manufacturing Costs Works**

The flow of manufacturing costs refers to the process of using materials and labor to complete a finished product that can be sold to a customer. A supply chain management system can reduce the cost and complexity of the manufacturing process, particularly for a manufacturer who uses many parts.

For example, a clothing manufacturer may first move raw materials into production, such as fabric, zippers, and other pieces used to make clothing. The manufacturer then incurs labor costs to run machinery and perform other work using the materials. Once the items are completed, they must be packaged and stored until they are sold to a customer.

**2.3 Reliable Suppliers**

An efficient supply chain management process requires reliable suppliers. This means they produce a quality product that meets the manufacturer's needs, and the product is delivered on time.

Assume, for example, that XYZ Furniture manufactures high-end furniture, and that a supplier provides metal handles and other attachments. The metal components need to be durable so they can be used on the furniture for years, and the metal parts shipped to XYZ should work as intended. The supplier must be able to fill the manufacturer's orders and ship metal parts to meet XYZ's production needs. These steps are necessary to produce a quality product that is shipped to a customer in a timely manner.

**2.4 Supply Chain and Deflation**

The evolution and increased efficiencies of supply chains have played a significant role in curbing inflation. As efficiencies in moving products from A to B increase, the costs in doing so decrease, which lowers the final cost to the consumer. While deflation is often regarded as a negative, supply chain efficiencies are one of the few examples where deflation is a good thing.

As globalization continues, supply chain efficiencies become more optimized, which keeps the pressure on input prices.

**2.5 Supply Management vs. Supply Chain Management**

The terms supply management and supply chain management are sometimes used interchangeably. But there is a difference. Supply chain management actually refers to the management of how goods and services flow through the production process—from raw material to finished goods that end up in the hands of consumers. This includes shipping, production, and distribution of products, goods, and services.

Supply chain management requires suppliers and managers to be as efficient as possible. This means they must make sure activities are streamlined so there are no shortages, costs are kept down, and businesses can remain competitive in the market.

## 3. Stages in developing asupply chain

**3.1 Stage 1: Plan**

Planning involves a wide range of activities. Companies must first decide on their operations strategy. Whether to manufacture a product or component or buy it from a supplier is a major decision.

3.1.1 Options include:

- Manufacturing a product component domestically
- Manufacturing a component in a foreign market by setting up international production facilities
- Buying a component from a foreign supplier
- Buying a component from a domestic supplier

If companies are manufacturing products, they must decide how they will be produced. Goods can be:

- Make to stock (produced and stored, awaiting customer orders);

- Make to order (constructed in response to a customer order);
- Configure to order (partially manufactured the product and completed it after a firm customer order is received);
- Engineer to order (manufactured a product to unique specifications provided by a customer).

Sometimes, goods can be produced by a combination of these methods. Companies must also decide whether they will outsource manufacturing. This operations planning is essential because these decisions influence the supply chain. Planning also involves mapping out the network of manufacturing facilities and warehouses, determining the levels of production and specifying transportation flows between sites. It also involves assessing how to improve the global supply chain and its management processes. When planning, companies should ensure that their supply chain management strategies align to business strategies, that communication plans for the entire supply chain are decided and that methods of measuring performance and gathering data are established before planning begins.

### 3.2 Stage 2: Source

This aspect of supply chain management involves organizing the procurement of raw materials and components.

When sources have been selected and vetted, companies must negotiate contracts and schedule deliveries. Supplier performance must be assessed and payments to the suppliers made when appropriate. In some cases, companies will be working with a network of suppliers. This will involve working with this network, managing inventory and company assets and ensuring that export and import requirements are met.

### 3.3 Stage 3: Make

This stage is concerned with scheduling of production activities, testing of products, packing and release. Companies must also manage rules for performance, data that must be stored, facilities and regulatory compliance.

### 3.4 Stage 4: Deliver

The delivery stage encompasses all the steps from processing customer inquiries to selecting distribution strategies and transportation options. Companies must also manage warehousing and inventory or pay for a service provider to manage these tasks for them. The delivery stage includes any trial period or warranty period, customers or retail sites must be invoiced and payments received, and companies must manage import and export requirements for the finished product.

### 3.5 Stage 5: Return

Return is associated with managing all returns of defective products, including identifying the product condition, authorizing returns, scheduling product shipments, replacing defective products and providing refunds. Returns also include “end-of-life” products (those that are in the end of their product lifetime and a vendor will no longer be marketing, selling, or promoting a particular product and may also be limiting or ending support for the product). Companies must establish rules for the following: Product returns Monitoring performance and costs Managing inventory of returned product.

## 4. Inventory Management

One of the basic objectives of SCM is to make sure that all the activities and functions within as well as across the company are managed efficiently.

### 4.1 Role of Inventory

Before understanding the role of inventory in supply chain, we need to understand the cordial relationship between the manufacturer and the client.

There are many instances where we see the concept of collaborative relationship being marked as the essence of supply chain management. However, a deeper analysis of supply chain relationships, especially those including product flows, exposes that at the heart of these relationships is inventory movement and storage.

More than half of it relies on the purchase, transfer or management of inventory. As we know, inventory plays a very important role in supply chains, being a salient feature.

The most fundamental functions that inventory has in supply chains are as follows −

- To supply and support the balance of demand and supply.
- To effectively cope with the forward and reverse flows in the supply chain.

### 4.2 Optimization Models

Optimization models of supply chain are those models that codify the practical or real life issues into mathematical model. The main objective to construct this mathematical model is to maximize or minimize an objective function. In addition to this, some constraints are added to these issues for defining the feasible region.

#### 4.2.1 Mixed Integer Linear Programming

The Mixed integer linear programming (MILP) is a mathematical modeling approach used to get the best outcome of a system with some restrictions. This model is broadly used in many optimization areas such as production planning, transportation, network design, etc.

MILP comprises a linear objective function along with some limitation constraints constructed by continuous and integer variables. The main objective of this model is to get an optimal solution of the objective function. This may be the maximum or minimum value but it should be achieved without violating any of the constraints imposed.

We can say that MILP is a special case of linear programming that uses binary variables. When compared with normal linear programming models, they are slightly tough to solve. Basically the MILP models are solved by commercial and noncommercial solvers, for example: Fico Xpress or SCIP.

#### 4.2.2 Stochastic Modeling

Stochastic modeling is a mathematical approach of representing data or predicting outcomes in situations where there is randomness or unpredictability to some extent.

For example, in a production unit, the manufacturing process generally has some unknown parameters like quality of the input materials, reliability of the machines and competence within the employees. These parameters have an impact on the outcome of the manufacturing process but it is impossible to measure them with absolute values.

In these types of cases, where we need to find absolute value for unknown parameters, which cannot be measured exactly, we use Stochastic modeling approach. This modeling strategy helps in predicting the result of this process with some defined error rate by considering the unpredictability of these factors.

#### 4.2.3 Uncertainty Modeling

While using a realistic modeling approach, the system has to take uncertainties into account. The uncertainty is evaluated to a level where the uncertain characteristics of the system are modeled with probabilistic nature.

We use uncertainty modeling for characterizing the uncertain parameters with probability distributions. It takes dependencies into account easily as input just like Markov chain or may use the queuing theory for modeling the systems where waiting has an essential role. These are common ways of modeling uncertainty.

#### 4.2.4 Bi-level Optimization

A bi-level issue arises in real life situations whenever a decentralized or hierarchical decision needs to be made. In these types of situations, multiple parties make decisions one after the other, which influences their respective profit.

Till now, the only solution to solve bi-level problems is through heuristic methods for realistic sizes. However, attempts are being made for improving these optimal methods to compute an optimal solution for real problems as well.

## 5. Integration

Supply chain integration can be defined as a close calibration and collaboration within a supply chain, mostly with the application of shared management

Volume: 04 Issue: 11 | Nov -2020 ISSN: 2582-3930

information systems. A supply chain is made from all parties that participate in the completion of a purchase, like the resources, raw materials, manufacturing of the product, shipping of completed products and facilitating services.

There are different levels of supply chain integration. We will understand this with the help of an example of a computer manufacturing company. The initial step in integration shall include choosing precise merchants to supply certain inputs and ensuring compliance for them for supplying certain amount of inputs within the year at a set cost.

This assures that the company has the appropriate materials required to produce the expected output of computers during the year. In the meanwhile, this computer company may sign a bond with a large supplier of circuit boards; the bond expects it to deliver a precise quantity at precise times within a year and fix a price that will be effective during the bond year.

### 5.1 Push System

In a push-based supply chain, the goods are pushed with the help of a medium, from the source point, e.g., the production site, to the retailer, e.g., the destination site. The production level is set in accordance with the previous ordering patterns by the manufacturer.

A push-based supply chain is time consuming when it has to respond to fluctuations in demand, which can result in overstocking or bottlenecks and delays, unacceptable service levels and product obsolescence.

This system is based on the deliberation of customer's demand. It tries to push as many products into the market as possible. As a result, the production is time consuming because the producer and the retailer struggle to react to the changes in the market. Forecast or prediction plays an important role in the push system.

Optimum level of products can be produced through long term prediction. This deliberative nature of the push system leads to high production cost, high inventory cost as well as high shipment cost due to the company's desire to halt products at every stage.

Thus, in the push view of supply chain integration, the manager of a firm may sometimes fail to satisfy or cope with the fluctuating demand pattern. This system leads to high inventory and high size of batches.

Here, the companies focus more on minimizing the cost of supply chain and neglect the responsiveness. This system models challenges along with demand management and transportation management.

### 5.2 Pull System

The pull-based supply chain is based on demand-driven techniques; the procurement, production and distribution are demand-driven rather than predicting. This system doesn't always follow the make-to-order production. For example, Toyota Motors Manufacturing produces products yet do not religiously produce to order. They follow the supermarket model.

According to this model, limited inventory is kept and piled up as it is consumed. Talking about Toyota, Kanban cards are used to hint at the requirement of piling up inventory.

In this system, the demand is real and the company responds to the customer demands. It assists the company in producing the exact amount of products demanded by the clients.

The major drawback in this system is that in case the demand exceeds than the amount of products manufactured, then the company fails to meet the customer demand, which in turn leads to loss of opportunity cost.

Basically in the pull system, the total time allotted for manufacturing of products is not sufficient. The production unit and distribution unit of the company rely on the demand. From this point of view, we can say that the company has a reactive supply chain.

Thus, it has less inventories as well as variability. It minimizes the lead time in the complete process. The biggest drawback in pull based supply chain integration is that it can't minimize the price by ranking up the production and operations.

Volume: 04 Issue: 11 | Nov -2020 ISSN: 2582-3930

### 5.3 Differences in Push and Pull System

The major differences between push and pull view in supply chain are as follows:

| Push System | Pull System |
|---|---|
| In the push system, the implementation begins in anticipation of customer order | In the pull system, the implementation starts as a result of customer's order |
| In the push system, there is an uncertainty in demand | In pull system, the demand remains certain. |
| The push system is a speculative process | The pull system is a reactive process. |
| The level of complexity is high in the push system | The level of complexity is low in the pull system |
| The push based system concentrates on resources allocation | The pull system stresses on responsiveness. |
| The push system has a long lead time | The pull system has a short lead time |
| The push system assists in supply chain planning | The pull system facilitates in order completion |

To conclude, the push based supply chain integrations works with an objective of minimizing the cost whereas the pull based supply chain integration works with an objective to maximize the services it provides.

### 5.4 Push & Pull System

Mostly we find a supply chain as merger of both push and pull systems, where the medium between the stages of the push-based and the pull-based systems is referred as the push–pull boundary.

The terms push and pull were framed in logistics and supply chain management, but these terms are broadly used in the field of marketing as well as in the hotel distribution business.

To present an example, Wal-Mart implements the push vs. pull strategy. A push and pull system in business represents the shipment of a product or information between two subjects. Generally, the consumers use pull system in the markets for the goods or information they demand for their requirements whereas the merchants or suppliers use the push system towards the consumers.

In supply chains, all the levels or stages function actively for the push and the pull system. The production in push system depends on the demand predicted and production in pull system depends on absolute or consumed demand.

The medium between these two levels is referred as the push–pull boundary or decoupling point. Generally, this strategy is recommended for products where uncertainty in demand is high. Further, economies of scale play a crucial role in minimizing production and/or delivery costs.

For example, the furniture industries use the push and pull strategy. Here the production unit uses the pull-based strategy because it is impossible to make production decisions on the basis on long term prediction. Meanwhile, the distribution unit needs

to enjoy the benefits of economy of scale so that the shipment cost can be reduced; thus it uses a push-based strategy.

Companies that opt to participate in supply chain management initiatives accept a specific role to enact. They have a mutual feeling that they, along with all other supply chain participants, will be better off because of this collaborative effort. The fundamental issue here is power. The last two decades have seen the shifting of power from manufacturers to retailers.

When we talk about information access for the supply chain, retailers have an essential designation. They emerge to the position of prominence with the help of technologies. The advancement of inter organizational information system for the supply chain has three distinct benefits. These are −

- **Cost reduction** − The advancement of technology has further led to ready availability of all the products with different offers and discounts. This leads to reduction of costs of products.
- **Productivity** − The growth of information technology has improved productivity because of inventions of new tools and software. That makes productivity much easier and less time consuming.
- **Improvement and product/market strategies** − Recent years have seen a huge growth in not only the technologies but the market itself. New strategies are made to allure customers and new ideas are being experimented for improving the product.

## 6. Role of IT

It would be appropriate to say that information technology is a vital organ of supply chain management. With the advancement of technologies, new products are being introduced within fraction of seconds increasing their demand in the market. Let us study the role of information technology in supply chain management briefly.

The software as well as the hardware part needs to be considered in the advancement and maintenance of supply chain information systems. The hardware part comprises computer's input/output devices like the screen, printer, mouse and storage media. The software part comprises the entire system and application program used for processing transactions management control, decision-making and strategic planning.

Here we will be discussing the role of some critical hardware and software devices in SCM. These are briefed below −

### 6.1 Electronic Commerce

Electronic commerce involves the broad range of tools and techniques used to conduct business in a paperless environment. Hence it comprises electronic data interchange, e-mail, electronic fund transfers, electronic publishing, image processing, electronic bulletin boards, shared databases and magnetic/optical data capture.

Electronic commerce helps enterprises to automate the process of transferring records, documents, data and information electronically between suppliers and customers, thus making the communication process a lot easier, cheaper and less time consuming.

### 6.2 Electronic Data Interchange

Electronic Data Interchange (EDI) involves the swapping of business documents in a standard format from computer-to-computer. It presents the capability as well as the practice of exchanging information between two companies electronically rather than the traditional form of mail, courier, & fax.

The major advantages of EDI are as follows −

- Instant processing of information
- Improvised customer service
- Limited paper work
- High productivity
- Advanced tracing and expediting
- Cost efficiency
- Competitive benefit
- Advanced billing

The application of EDI supply chain partners can overcome the deformity and falsehood in supply and demand information by remodeling

technologies to support real time sharing of actual demand and supply information.

### 6.3 Barcode Scanning

We can see the application of barcode scanners in the checkout counters of super market. This code states the name of product along with its manufacturer. Some other practical applications of barcode scanners are tracking the moving items like elements in PC assembly operations and automobiles in assembly plants.

### 6.4 Data Warehouse

Data warehouse can be defined as a store comprising all the databases. It is a centralized database that is prolonged independently from the production system database of a company.

Many companies maintain multiple databases. Instead of some particular business processes, it is established around informational subjects. The data present in data warehouses is time dependent and easily accessible. Historical data may also be accumulated in data warehouse.

### 6.5 Enterprise Resource Planning(ERP) Tools

The ERP system has now become the base of many IT infrastructures. Some of the ERP tools are Baan, SAP, PeopleSoft. ERP system has now become the processing tool of many companies. They grab the data and minimize the manual activities and tasks related to processing financial, inventory and customer order information.

ERP system holds a high level of integration that is achieved through the proper application of a single data model, improving mutual understanding of what the shared data represents and constructing a set of rules for accessing data.

With the advancement of technology, we can say that world is shrinking day by day. Similarly, customers' expectations are increasing. Also companies are being more prone to uncertain environment. In this running market, a company can only sustain if it accepts the fact that their conventional supply chain integration needs to be expanded beyond their peripheries.

The strategic and technological interventions in supply chain have a huge effect in predicting the buy and sell features of a company. A company should try to use the potential of the internet to the maximum level through clear vision, strong planning and technical insight. This is essential for better supply chain management and also for improved competitiveness.

We can see how Internet technology, World Wide Web, electronic commerce etc. has changed the way in which a company does business. These companies must acknowledge the power of technology to work together with their business partners.

We can in fact say that IT has launched a new breed of SCM application. The Internet and other networking links learn from the performance in the past and observe the historical trends in order to identify how much product should be made along with the best and cost effective methods for warehousing it or shipping it to retailer.

## 7. Conclusion

Supply Chain Management can be defined as the management of flow of products and services, which begins from the origin of products and ends at the product's consumption. It also comprises movement and storage of raw materials that are involved in work in progress, inventory and fully furnished goods.

The main objective of supply chain management is to monitor and relate production, distribution, and shipment of products and services. This can be done by companies with a very good and tight hold over internal inventories, production, distribution, internal productions and sales.

Supply chain management basically merges the supply and demand management. It uses different strategies and approaches to view the entire chain and work efficiently at each and every step involved in the chain. Every unit that participates in the process must aim to minimize the costs and help the companies to improve their long term performance, while also creating value for its stakeholders and customers. This process can also minimize the rates by eradicating the unnecessary expenses, movements and handling.

### 7.1 Advantages

- Develops better customer relationship and service.
- Creates better delivery mechanisms for products and services in demand with minimum delay.
- Improvises productivity and business functions.
- Minimizes warehouse and transportation costs.
- Minimizes direct and indirect costs.
- Assists in achieving shipping of right products to the right place at the right time.
- Enhances inventory management, supporting the successful execution of just-in-time stock models.
- Assists companies in adapting to the challenges of globalization, economic upheaval, expanding consumer expectations, and related differences.
- Assists companies in minimizing waste, driving out costs, and achieving efficiencies throughout the supply chain process.

### 7.2 Goals

- Supply chain partners work collaboratively at different levels to maximize resource productivity, construct standardized processes, remove duplicate efforts and minimize inventory levels.
- Minimization of supply chain expenses is very essential, especially when there are economic uncertainties in companies regarding their wish to conserve capital.
- Cost efficient and cheap products are necessary, but supply chain managers need to concentrate on value creation for their customers.
- Exceeding the customers' expectations on a regular basis is the best way to satisfy them.
- Increased expectations of clients for higher product variety, customized goods, off-season. Availability of inventory and rapid fulfillment at a cost comparable to in-store offerings should be matched.
- To meet consumer expectations, merchants need to leverage inventory as a shared resource and utilize the distributed order management technology to complete orders from the optimal node in the supply chain.
- Lastly, supply chain management aims at contributing to the financial success of an enterprise. In addition to all the points highlighted above, it aims at leading enterprises using the supply chain to improve differentiation, increase sales, and penetrate new markets. The objective is to drive competitive benefit and shareholder value.

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