CHAPTER: III
THEORETICAL FRAMEWORK OF SUPPLY CHAIN MANAGEMENT

3.1 INTRODUCTION

The last decade of the twentieth century was a period of rapid change for organizations, especially in business. That rate of change has not slowed down and is actually increasing in the twenty-first century. The forces of change require organizations to be much more nimble and responsive, that is, organizations need to be transforming themselves to survive in the intensely competitive global environment. Change is inevitable, but growth and improvement are optional.

The current economic downturn has brought significant changes in the way business is done today. Managers in the rapidly changing high-tech and competitive environment of business face tough questions every day. Supply chain solution, when properly deployed, may provide high-quality business information to many different types of employees throughout the enterprise as well as to business partners and customers. SCM and logistics are key ingredients for success in today’s highly competitive global environment.

Managing supply chain requires retailers to perform a delicate “balancing act” that simultaneously meets multiple needs. While delivering high service levels, as they manage global supply chains, retailers must keep costs low in order to remain competitive. Other pressures come from more demanding customers as well as from the increasingly global nature of the industry, which has retailers both sourcing and selling products in more places around the world. By better connecting product information, processes, systems, and people any company with its partners, can address both current and future complexity in this area with cost effective, integrated solutions that help retailers drive enhanced supply chain efficiency and trading partner collaboration. This chapter is about the basic definitions of SCM, objectives and importance of SCM, basic components of SCM. Elements and Decision phases of
SCM is followed by the decision phases in SCM. The process view of the SCM also clearly explained. SCM macro process in a firm is clearly mentioned and drivers of SCM performance evaluated. The transportation facilities and its related metrics are also highlighted.

### 3.2 CONCEPT OF SUPPLY CHAIN

SCM is the term used to describe the management of the flow of materials, information, and funds across the entire supply chain, from suppliers to component producers to final assemblers to distribution (warehouses and retailers), and ultimately to the consumer. SCM typically involves coordination of information and materials among multiple firms.

SCM approaches used to efficiently integrate suppliers, manufacturers, warehouses, and customers so that the product is produced and distributed at the right quantities, to the right locations, and at the right time with right price. SCM is regarded as channels of distribution. From this perspective the focus of channel management is on making each firm in the distribution channel more efficient and productive. Each firm operated on its own, seeking to make the highest profits with little attention paid to its channel counterparts.

More recently, many manufacturers and retailers have embraced the concept of supply chain management to improve efficiency across the value chain. The original use of the term SCM emphasized a reduction in inventory both within and across firms, which the logistics manager is confronted with, but that initial perspective has been broadening.

Cost and service improvements that are not achievable by individual firms, will now be attained by cooperating companies. SCM is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers. SCM spans all movement and storage of raw
SCM is the design, planning, execution, control and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally.

SCM is the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.

Supply chain strategies require a total systems view of the linkages in the chain that work together efficiently to create customer satisfaction at the end point of delivery to the consumer. As a consequence costs must be lowered throughout the chain by driving out unnecessary costs and focusing attention on adding value. The supply chain system must be responsive to customer requirements.

SCM is the integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders. SCM encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes the crucial components of coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, SCM integrates supply and demand management within and across companies.

SCM is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may vary greatly from industry to industry and firm to firm. SCM is the combination of art and science that goes into improving the
way the company finds the raw components it needs to make a product or service and deliver it to customers.

Supply chain activities transform natural resources, raw materials and components into a finished product that is delivered to the end customer. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. SCM is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model.

In the 1980s, the term SCM was developed to express the need to integrate the key business processes, from end user through original suppliers. Original suppliers being those that provide products, services and information that add value for customers and other stakeholders. The basic idea behind the SCM is that companies and corporations involve themselves in a supply chain by exchanging information regarding market fluctuations and production capabilities.

The process of planning, organizing and controlling the flow of materials and services from suppliers and end users or customers is an integrated approach that incorporates suppliers, supply management, integrated logistics and operation. SCM begins with intensive cost negotiation to obtain long term agreements with tier one and two suppliers. SCM will classify suppliers as approved preferred or alliance. In working with preferred and approved suppliers, supply chain managers may choose competitive quotes and prices analysis as the best method to conduct business.

Supply management evolved through four stages. If started as a pure purchasing function subordinate to the more important function of marketing, finance and operation. As the cost of purchased item increased firms gave more attention to purchasing which had become part of a large system referred to as material management.

From the above definitions it is clear that SCM is:
i) the systematic way to increase the overall performance of the company.

ii) Integrate all operational activities such as organization, people, technology, activities, information and resources.

iii) increase the distribution performance of the company.

iv) reduce the cost of the product.

v) helps in planning and management of all activities involved in sourcing, procurement, conversion.

3.3 OBJECTIVE OF SCM

The main objective of SCM is to fulfill customer demands through the most efficient use of resources, including distribution capacity, inventory and labour. Supply chain seeks to match demand with supply and do so with the minimal inventory. Various aspects of optimizing the supply chain include liaising with suppliers to eliminate bottlenecks, sourcing strategically to strike a balance between lowest material cost and transportation, implementing Just In Time (JIT) techniques to optimize manufacturing flow, while maintaining the right mix and location of factories and warehouses to serve customer markets.

Every supply chain should be maximizing the overall value generated. The value a supply chain generates is the difference between what the final product is worth to the customer and the costs the supply chain occurs in filling the customers’ request. For most commercial supply chains, value will be strongly correlated with supply chain profitability, the difference between the revenue generated from the customer and the overall cost across the supply chain. The important objectives of SCM are enhancing customer Service, expanding sales revenue, reducing inventory cost, improving on-time delivery, and reducing order to delivery cycle time, reducing lead time, reducing transportation cost, reducing warehouse cost, reducing supplier base and expanding width or depth of distribution.

3.4 BASIC COMPONENTS OF SCM
The basic components of SCM are plan, source, make, deliver and return. The activities of the components are given below.

1. **Plan**: This is the strategic portion of SCM. Companies need a strategy for managing all the resources that go toward meeting customer demand for their product or service. A big piece of SCM planning is developing a set of metrics to monitor the supply chain so that it is efficient, costs less and delivers high quality and value to customers.

2. **Source**: Companies must choose suppliers to deliver the goods and services they need to create their product. Therefore, supply chain managers must develop a set of pricing, delivery and payment processes with suppliers and create metrics for monitoring and improving the relationships. SCM managers can put together processes for managing their goods and services inventory, including receiving and verifying shipments, transferring them to the manufacturing facilities and authorizing supplier payments.

3. **Make**: This is the manufacturing step. Supply chain managers schedule the activities necessary for production, testing, packaging and preparation for delivery. This is the most metric-intensive portion of the supply chain, one where companies are able to measure quality levels, production output and worker productivity.

4. **Deliver**: This is the part that many SCM insiders refer to as logistics, where companies coordinate the receipt of orders from customers, develop a network of warehouses, pick carriers to get products to customers and set up an invoicing system to receive payments.

5. **Return**: This can be a problematic part of the supply chain for many companies. Supply chain planners have to create a responsive and flexible network for receiving defective and excess products back from their customers and supporting customers who have problems with delivered products.

**3.5 ELEMENTS OF SCM**
A simple supply chain is made up of several elements that are linked by the movement of products along it. The supply chain starts and ends with the customer.

1) **Customer**: The customer starts the chain of events when he decides to purchase a product that has been offered for sale by a company. The customer contacts the sales department of the company, which enters the sales order for a specific quantity to be delivered on a specific date. If the product has to be manufactured, the sales order will include a requirement that needs to be fulfilled by the production facility.

2) **Planning**: The requirement triggered by the customer’s sales order will be combined with other orders. The planning department will create a production plan to produce the products to fulfill the customer’s orders. To manufacture the products the company will then have to purchase the raw materials needed.

3) **Purchasing**: The purchasing department receives a list of raw materials and services required by the production department to complete the customer orders. The purchasing department sends purchase orders to selected suppliers to deliver the necessary raw materials to the manufacturing site on the required date.

4) **Inventory**: The raw materials are received from the suppliers, checked for quality and accuracy and moved into the warehouse. The supplier will then send an invoice to the company for the items they delivered. The raw materials are stored until they are required by the production department.

5) **Production**: Based on a production plan, the raw materials are moved to the production area. The finished products ordered by the customers are manufactured using the raw materials purchased from suppliers. After the items have been completed and tested, they are stored back in the warehouse prior to delivery to the customer.

6) **Transportation**: When the finished product arrives in the warehouse, the transport department determines the most efficient method to transport the products so that they are delivered on or before the date specified by the customer. When the goods are
received by the customer, the company will send an invoice for the delivered products.

3.6 PHASES OF SCM

Successful SCM requires many decisions relating to the flow of information, product and funds. Each decision should be made to raise the supply chain surplus. The decisions fall into three phases such as supply chain strategy or design, supply chain planning and supply chain operation

3.6.1 Supply Chain Strategy or Design

During this phase, given the marketing and pricing plans for a product, a company decides how to structure the supply chain over the next several years. It decides what the chains configuration will be, how resources will be allocated, and what process each stage will perform. Strategic decisions made by companies include whether to outsource or perform a supply chain function in-house, the location and capacities of production and warehousing facilities, the products to be manufactured or stored at various location, the modes of transportation system to be made available along different transportation legs, and the type of information system to be utilized.

3.6.2 Supply Chain Planning

For decisions made during this phase, the time frame considered in a quarter to a year. Therefore, the supply chain’s configuration determined in the strategic phase is fixed. The goal of planning is to maximize the supply chain surplus that can be generated over the planning horizon given the constraints established during the strategic or design phase. Companies start the planning phase with a forecast for the coming year of demand in different markets. Planning includes making decisions regarding which markets will be supplied from which locations, the sub contracting of
manufacturing, the inventory policies to be followed and the timing and size of marketing and price promotions. As a result of the planning phase, companies define a set of operating policies that govern short term operations.

3.6.3 Supply Chain Operations

The goal of supply chain operations is to handle incoming customer orders in the best possible manner. During this phase, firms allocate inventory or production to individual orders, set a date that an order is to be filled, generate pick list a warehouse, and allocate an order to a particular shipping mode and shipment, set delivery schedule of trucks and place replacement order. Because operational decisions are being made in the short term (minutes, hours or days), there is less uncertainty about demand information. The goal during the operation phase is to exploit the reduction of uncertainty and optimize performance. The design, planning and operations of a supply chain have a strong impact on overall profitability and success.

3.7 SUPPLY CHAIN PROCESS CYCLE

A supply chain is a sequence of processes and flows that take place within and between different stages and combine to fill a customer need for a product. The supply chain process can be broken down into four cycle namely customer order cycle, replenishment cycle, manufacturing cycle and procurement cycle which is given in Figure 3.1. Each cycle occurs at the interface between two successive stages of the supply chain.

Each cycle consists of six sub processes as shown in Figure 3.2. The cycle starts with the supplier marketing the product to customers. A buyer then places an order that is received by the supplier. The supplier supplies the order, which is received by the buyer. The buyer may return some of the product or other recycled material to the supplier or a third party. The cycle of activities then begins all over again.
Figure: 3.1

Supply chain Process Cycles


Figure: 3.2

Sub processes in each supply chain process Cycle
3.8 SUPPLY CHAIN MACRO PROCESSES

All supply chain processes can be classified into three macro processes namely customer Relationship Management (CRM), Internal Supply Chain Management (ISCM) and Supplier Relationship Management (SRM)

The three macro processes manage the flow of information, product and funds required to generate, receive and fulfill a customer request. The CRM macro process focuses on the interface between the firm and its customers. It aims to generate customer demand and facilitate the placement and tracking of orders. It includes processes such as marketing, pricing, sales, order management and call center management.

The ISCM processes that is internal to the firm. It aims to fulfill the demand generated by the CRM process in a timely manner and at the lowest possible cost. ISCM processes include planning for the location and size warehouses, deciding which products to carry at each warehouse, preparing inventory management policies and picking, and shipping actual orders.

The SRM processes focus on the interface between the firm and its suppliers. It aims to arrange for and manage supply sources for various goods and services. SRM processes included the evaluation and selection of suppliers, negotiation of supply terms, and communication regarding news products and orders with suppliers.

Figure: 3.3

Supply chain Macro processes

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3.9 DRIVERS OF SUPPLY CHAIN PERFORMANCE

The following are the important SCM drivers namely facilities, inventory, transportation, information, sourcing and pricing. The detailed explanation is given below:

3.9.1 FACILITIES

Facilities are the actual physical locations in the supply chain network where product is stored and assembled. The two major types of facilities are production sites and storages sites. Decisions regarding the role location, capacity and flexibility of facilities have a significant impact on the supply chains performance.

Facilities are key drivers of supply chain performance in terms of responsiveness and efficiency. Companies can gain economies of scale when a product is manufactured or stored in only one location. This centralization increases efficiency. Locating facilities close to customers increases the number of facilities needed and consequently reduces efficiency. If the customer demands and is willing to pay for the responsiveness that having numerous facilities adds, then this facilities decision helps meet the company competitive strategy goals.

3.9.1.1 Facility Related Metrics

The following facility related metrics influence supply chain performance.

1) **Capacity**: Measures the maximum amount a facility can process
2) **Utilization:** Measures the fraction of capacity that is currently being used in the facility. Utilization affects both the unit cost of processing and the associated delays. Unit cost tends to decline and delays increase with increasing utilization.

3) **Theoretical flow/cycle time:** Measures the time required to process a unit if there are absolutely no delays at any stage.

4) **Actual average flow/cycle time:** Measures the average actual time taken for all units processed over a specified duration such as a week or month.

5) **Flow time efficiency:** is the ratio of the theoretical flow time to the actual average flow time.

6) **Product variety:** Measures the number of products/product processed in a facility.

7) **Processing/setup/down/idle time:** Measures the fraction of time that the facility was processing units, being set up to process units, unavailable because it was down, or idle because it had no units to process.

8) **Average production batch size:** Measures the average amount produced in each production batch. Large batch sizes will decrease production cost but increase inventories in the supply chain.

9) **Production service level:** Measures the fraction of production orders completed on time and in full.

3.9.2 **INVENTORY**

Encompasses all raw materials, work in process and finished goods within a supply chain. Changing inventory policies can dramatically alter the supply chains efficiency and responsiveness. An important role that inventory plays in the supply chain is to increase the amount of demand that can be satisfied by having the product
ready and available when the customer wants it. Another significant role that inventory plays is to reduce cost by exploiting economies of scale that may exist during production and distribution. Inventory also has a significant impact on the material flow time in a supply chain. Material flow time is the time that elapses between the points at which material enters the supply chain to the point at which it exits.

### 3.9.2.1 Inventory Related Metrics

The following inventory related metrics that influence supply chain performance:

1. **Average Inventory**: Measures the average amount of inventory carried. Average inventory should be measured in units, days of demand and financial value.

2. **Products with more than specified number of days of inventory**: identifies the products for which the firm is carrying a high level of inventory. This metric can be used to identify products that are in oversupply.

3. **Average replenishment batch size**: Measures the average amount in each replenishment order.

4. **Average safety inventory**: Measures the average amount of inventory on hand when a replenishment order arrives.

5. **Seasonal inventory**: Measures the amount of both cycle and safety inventory that is purchased solely due to seasonal changes in demand.

6. **Fill rate**: Measures the fraction of orders/demand that were met on time from inventory.

7. **Fraction of time out of stock**: Measures the fraction of time. This fraction can be used to estimate the demand during the stock out period.
3.9.3 TRANSPORTATION

Transportation entails moving inventory from point to point in the supply chain. Transportation moves product between different stages in a supply chain. Like the other supply chain drivers, transportation has a large impact on both responsiveness and efficiency. Faster transportation allows a supply chain to be more responsive but reduces its efficiency.

3.9.3.1 Transportation related Metrics

The following are the transportation related metrics that influence supply chain performance.

1) **Average inbound transportation cost**: Typically measures the cost of bringing products into a facility as a percentage of sales or cost of goods sold.

2) **Average incoming shipment size**: Measures the average number of units in each incoming shipment at a facility.

3) **Average inbound transportation cost per shipment**: Measures the average transportation cost of each incoming delivery.

4) **Average outbound transportation cost**: Measures the cost of sending product out of a facility to the customer.

5) **Average outbound shipment size**: Measures the average number of units on each outbound shipment at a facility.

6) **Average outbound transportation cost per shipment**: Measures the average transportation cost of each outgoing delivery.

7) **Fraction transported by mode**: Measures the fraction of transportation using each mode of transportation.
3.9.4 INFORMATION

Information consists of data and analysis concerning facilities, inventory, transportation, costs, prices and customers throughout the supply chain. Information is potentially the biggest driver of performance in the supply chain because it directly affects each of the other drivers. Information deeply affects every part of the supply chain. Information serves as the connection between various stages of a supply chain, allowing them to coordinate and maximize total supply chain profitability. Information is most valuable in reducing cost and improving responsiveness with in a supply chain.

3.9.4.1 Information Related Metrics

The following are the information related metrics that influence supply chain performance.

1) **Forecast horizon**: identifies how far in advance of the actual event a forecast is made.

2) **Frequency of update**: identifies how frequently each forecast is updated.

3) **Forecast error**: Measure the difference between the forecast and actual demand.

4) **Seasonal factors**: Measure the extent to which the average demand in a season is above or below the average in the year.

5) **Variance from plan**: identifies the difference between the planned production/inventories and the actual values.

6) **Ratio of demand variability to order variability**: Measures the standard deviation of incoming demand and supply orders placed.

3.9.5 SOURCING
Sourcing is the choice of who will perform a particular supply chain activity such as production, storage, transportation or the management of information. Sourcing is the set of business processes required to purchase goods and services. Sourcing decisions are crucial because they affect the level of efficiency and responsiveness the supply chain can achieve.

3.9.5.1 Sourcing related Metrics

The following are the sourcing related metrics that influence supply chain performance:

1) **Day’s payable outstanding**: Measures the number of days between when a supplier performed a supply chain task and when it is paid.

2) **Average purchase price**: Measures the average price at which a good or service is purchased during the year.

3) **Range of purchase**: Measures the fluctuation on purchase price during a specified period.

4) **Average purchase quantity**: Measures the average amount purchased per order.

5) **Fraction on time deliveries**: Measures the fraction of deliveries from the supplier that are on time.

6) **Supply quantity**: Measures the quantity of product supplied.

7) **Supply lead time**: Measures the average time between when an order is placed and the product arrives.

3.9.6 PRICING
Pricing determines how much a firm will charge for goods and services that it makes available in the supply chain. Pricing affects the behavior of the buyer of the good or service, thus affecting supply chain performance. Pricing is the process by which a firm decides how much to charge customers for its goods and services. Pricing affects the customers segments that choose to buy the product, as well as the customers’ expectations. Pricing is also the lever that can be used to match supply and demand. Short term discounts can be used to eliminate supply surpluses or decrease seasonal demand. Pricing is a significant attribute through which a firm executes its competitive strategy.

3.9.6.1 Pricing related metrics

The following are the pricing related metrics

1) **Profit margin**: Measures profit as a percentage of revenue.

2) **Days sales outstanding**: Measures the average time between when a sale is made and when the cash is collected.

3) **Incremental fixed cost per order**: Measures the incremental costs that are independent of the size of the order.

4) **Incremental variable cost per unit**: Measures the incremental costs that vary with the size of the order.

5) **Average sale price**: Measures the average price at which a supply chain activity is performed in a given period.

6) **Average order size**: Measures the average quantity per order

7) **Range of sale price**: Measures the maximum and the minimum of sale price per unit over a specified time horizon.
8) **Range of periodic sales**: Measures the maximum and minimum of the quantity sold per period during a specified time horizon.

### 3.10 CONCLUSION

In the 21st century due to the competitive edge the companies should maintain the quality, quantity, reasonable price at the right time. Companies want to create or maintain the strategies for the betterment of effective practices on SCM. SCM practices integrate all the activities of the organization and support to increase the performance of the company. The aggregate production planning activities strengthen the activities of the SCM practices. The SCM practices increase the level of customer satisfaction as well as loyalty of the product. The SCM metrics support the cost reduction reducing the cycle time and increase the quality.

**References**


