



UNIT-1

Introduction To Supply Chain And Logistics Management

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Describe what Supply Chain Management is.
- ✓ Explore Benefits of Supply Chain and its Working Procedures
- ✓ Identify the participants in Supply Chain.

Unit 1

Defining Supply Chain

The concept of Supply Chain Management originated in the late 1980s and became popular in the 1990s. Before the arrival of this concept, the terms operation management and logistics were used by the businesses. The following are several popular definitions of what a Supply Chain means.

- “A supply chain is the alignment of firms that bring products or services to market.”—from Lambert, Stock, and Ellram
- “A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves . . .”
—from Chopra and Meindl
- “A supply chain 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.”—from Ganeshan and Harrison

A **SUPPLY CHAIN** is comprised of a series of organisations and activities that are carried out as the materials move on their passage from primary suppliers to end customers.

What is Supply Chain Management

Supply Chain Management is the process of planning and maintaining the *movement* of materials and products among a number of companies to supply goods and services to final consumers. Suppose you want to buy a new car because your current model has worn out. You require a four-cylinder sedan with a mechanical gearbox, four doors, and air conditioning. This car needs 8,000 parts from 300 suppliers from different regions all over the globe. Consider the basic supply chain for a GM car which includes an ignition module manufactured by a firm called Bosch from metal tools supplied by Kawasaki Steel and assembled into the completed car by G M, which keeps a stock of finished cars. You intended to buy the finished car from a dealership in Melbourne, Australia. The basic supply chain is shown in the following Figure -

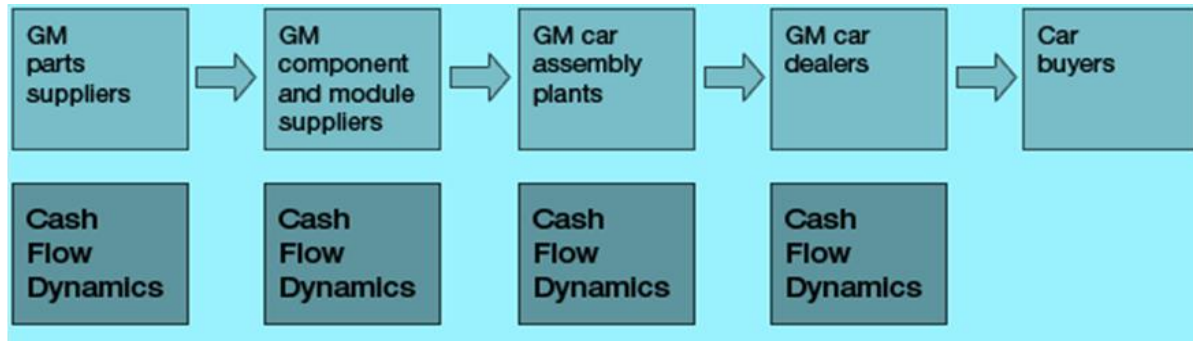


Fig: 1.1

Basic Supply Chain – Physical Movements

Until now, we have emphasized about the flow of materials through a single organisation. In reality, businesses do not work in seclusion, but each one acts as a consumer when it buys material from its own suppliers and then, it acts as a provider when it delivers materials to its consumers. A wholesaler, for instance, acts as a consumer when buying goods from producers, and then as a seller when selling goods to retail shops. A part maker buys raw materials from its suppliers, collects these into components, and passes the outcomes to other manufacturers. Most products flow through a chain of organisations as they travel between primary suppliers and end customers. Milk moves through a farm, tanker collection, dairy, bottling plant, distributor, and supermarket before we purchase it.

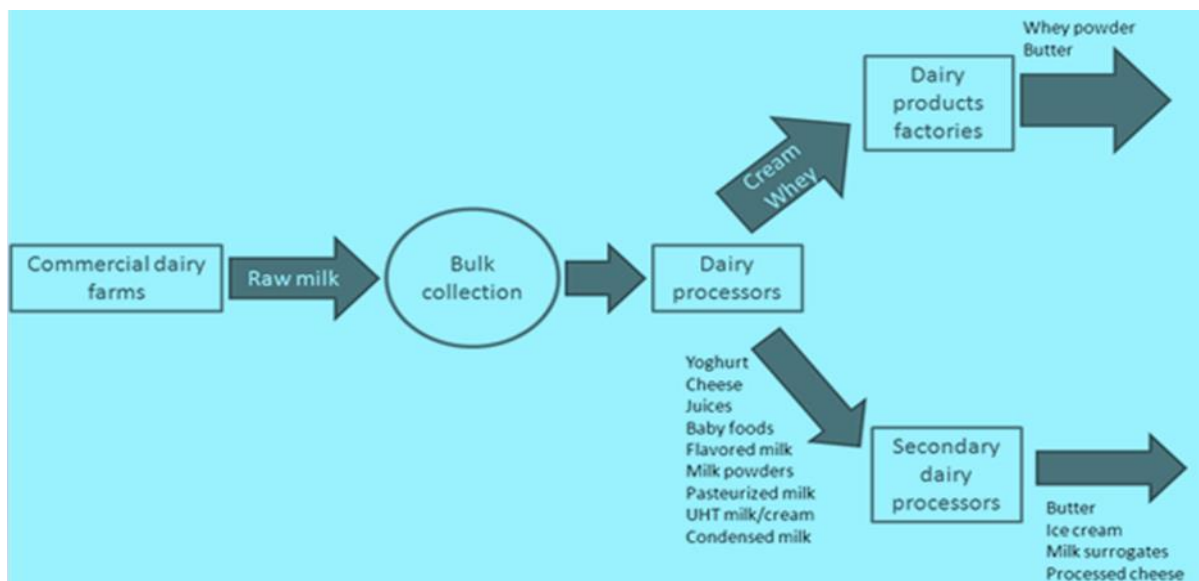


Fig: 1.2

A toothbrush starts its trip with a corporation that extracts crude oil and then, it passes through pipelines, refineries, chemical works, plastics companies, manufacturers, importers, wholesalers and retailers before consumed in your bathroom. A sheet of paper moves through numerous organisations before you put it on your desk. People use diverse names for these chains of activities and organisations.

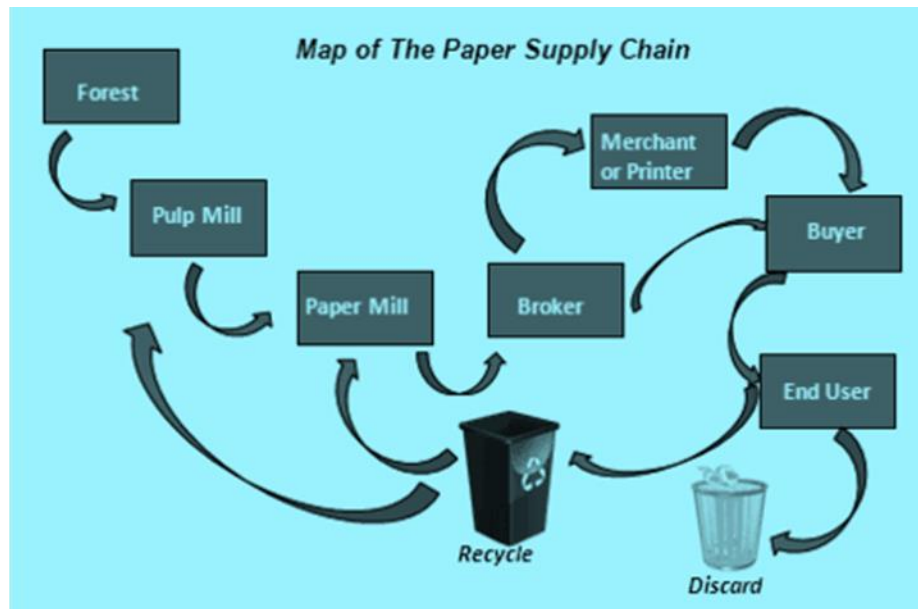


Fig: 1.3

When they highlight the operations, which is considered the **process**; when they focus on marketing, they call it a **logistics channel**; when they emphasize the value added, they call it a **value chain**, when they observe how shopper demands are fulfilled, they call it a **demand chain**. All this makes a **supply chain**.

In other words, we can explain this definition in the following way -

A SUPPLY CHAIN is comprised of a chain of activities and organisations in which materials flow on their journey from primary suppliers to end customers.

Each product has its own exclusive supply chain and these supply chains can be extended and difficult. For instance, the supply chain for Cadbury begins with cocoa beans growing on farms and ends with the delivery of chocolate bars to hungry consumers. The supply chain for Levi jeans begins with cotton growing in a field and ends when you purchase the jeans in a shop. The supply chain represents the entire journey of materials as they flow 'from dirt to dirt'. During the trip, materials might flow through raw materials suppliers, finishing operations, manufacturers, logistics centres, third party operators, warehouses, transport companies, wholesalers, retailers, and an entire range of other operations. Sometimes, the supply chain moves beyond the endcustomer to add re-use and recycling of materials.

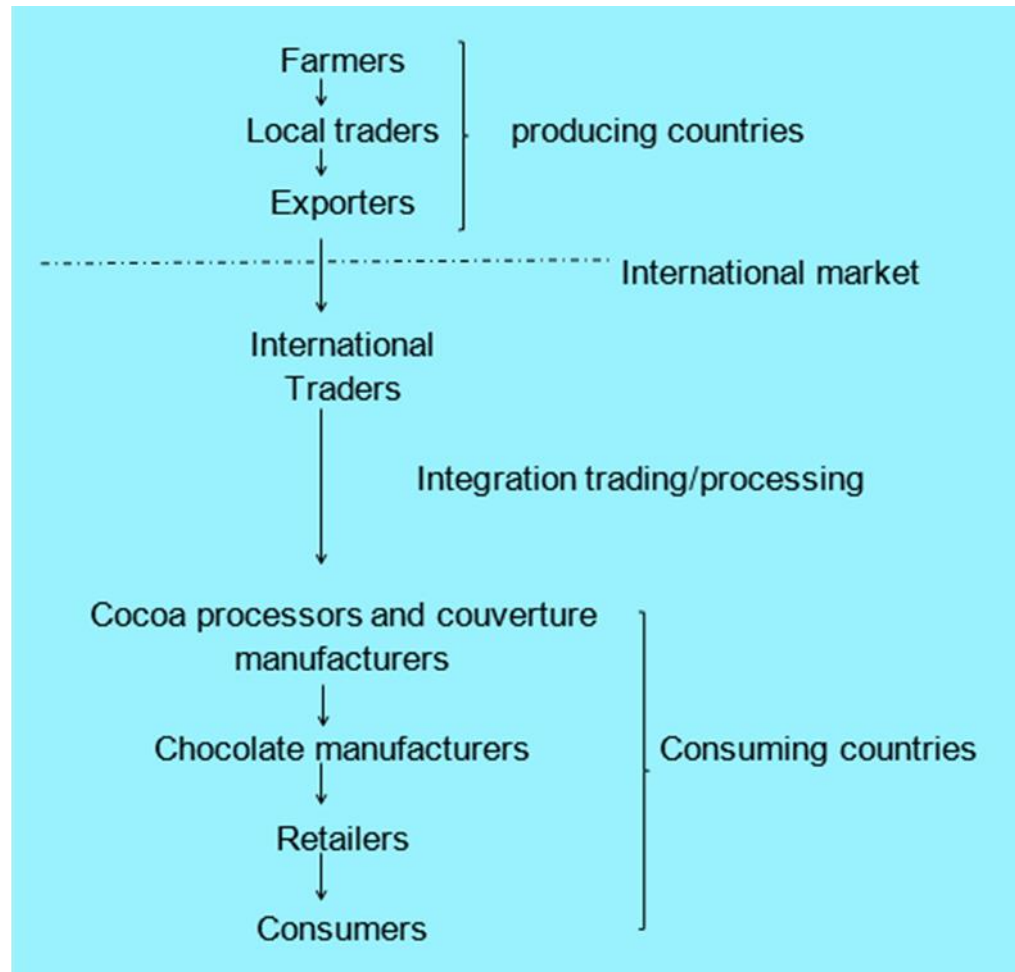


Fig: 1.4

There is a distinction between the idea of Supply Chain Management and the customary concept of logistics. Logistics usually refers to activities that happen within the boundaries of a particular organization and supply chains means networks of companies that work together and synchronize their actions to bring a product to market. Also, conventional logistics focuses its concentration on activities like procurement, distribution, protection, and inventory management. Supply Chain Administration acknowledges all of conventional logistics and also comprised of activities like marketing, finance, new product development, and customer service.

The Structure of a Supply Chain

The simplest way a supply chain works is when a single product passes through a chain of organisations, which, one way or other, adds value to the manufactured goods. Taking one organisation's perception, activities in front of it – flowing materials inwards – are called **upstream**; those after the organisation – flowing materials outwards – are called **downstream**.

The upstream activities are separated into **tiers** of suppliers. A supplier that drives materials straight to the operations is a first tier supplier; one that throws materials to a first tier supplier is a second tier supplier; one that sends materials to a second tier supplier is a third tier supplier, and so on back to the primary sources. Consumers are also divided into tiers. One that obtains a product straight from the operations is a first tier consumer; one that receives a product from a first tier consumer is a second tier customer; one that gets a product from a second tier customer is a third tier customer, and so on to end customers (see Figure 1.5)

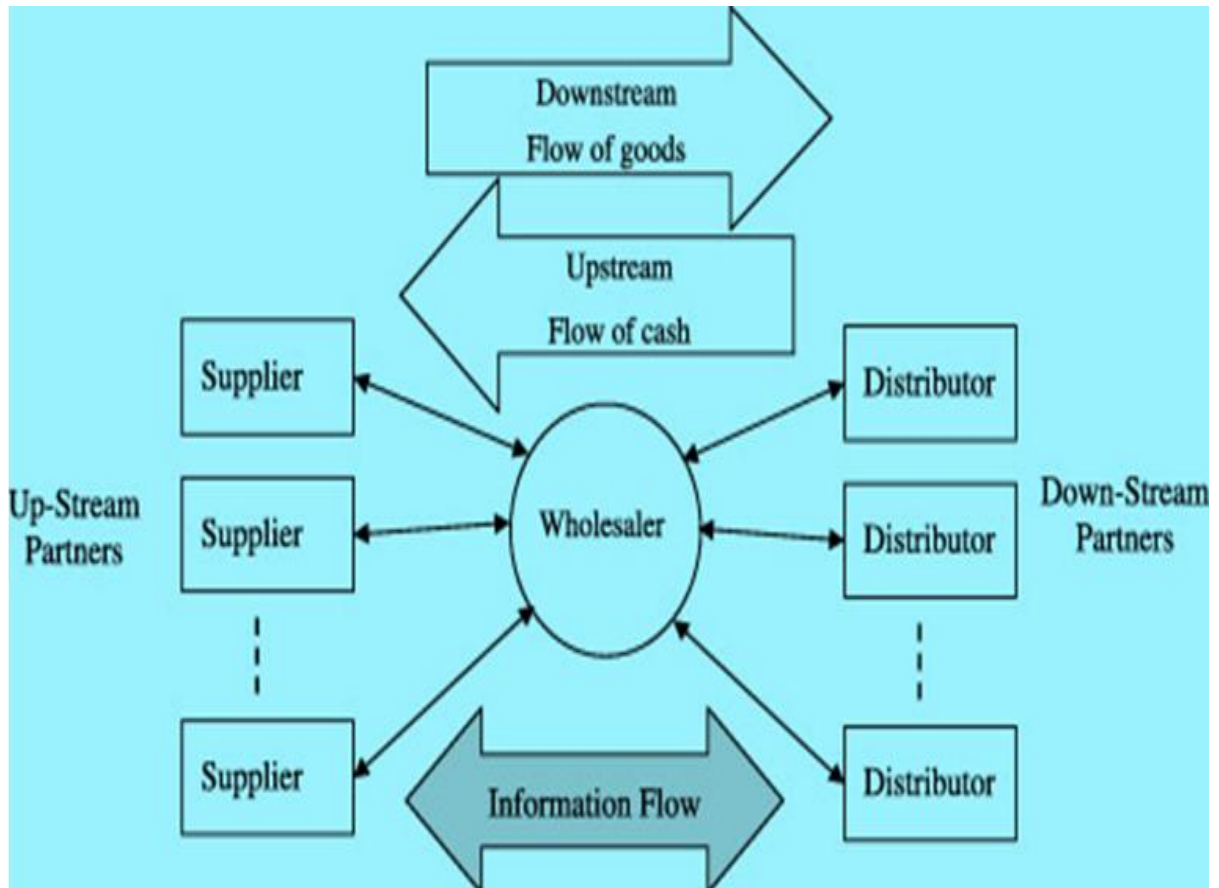


Figure 1.5 Activities in a supply chain

In practice, most of the organisations obtain materials from many suppliers, and sell products to a lot of diverse customers. Then the supply chain converges as raw materials flow in through the tiers of suppliers, and diverges as products flow out through tiers of customers. A producer may see sub-assembly providers as first tier suppliers, parts makers as second tier suppliers, materials suppliers as third tier suppliers, and so on. It may see wholesalers as first tier consumers, retailers as second tier consumers, and final users as third tier customers

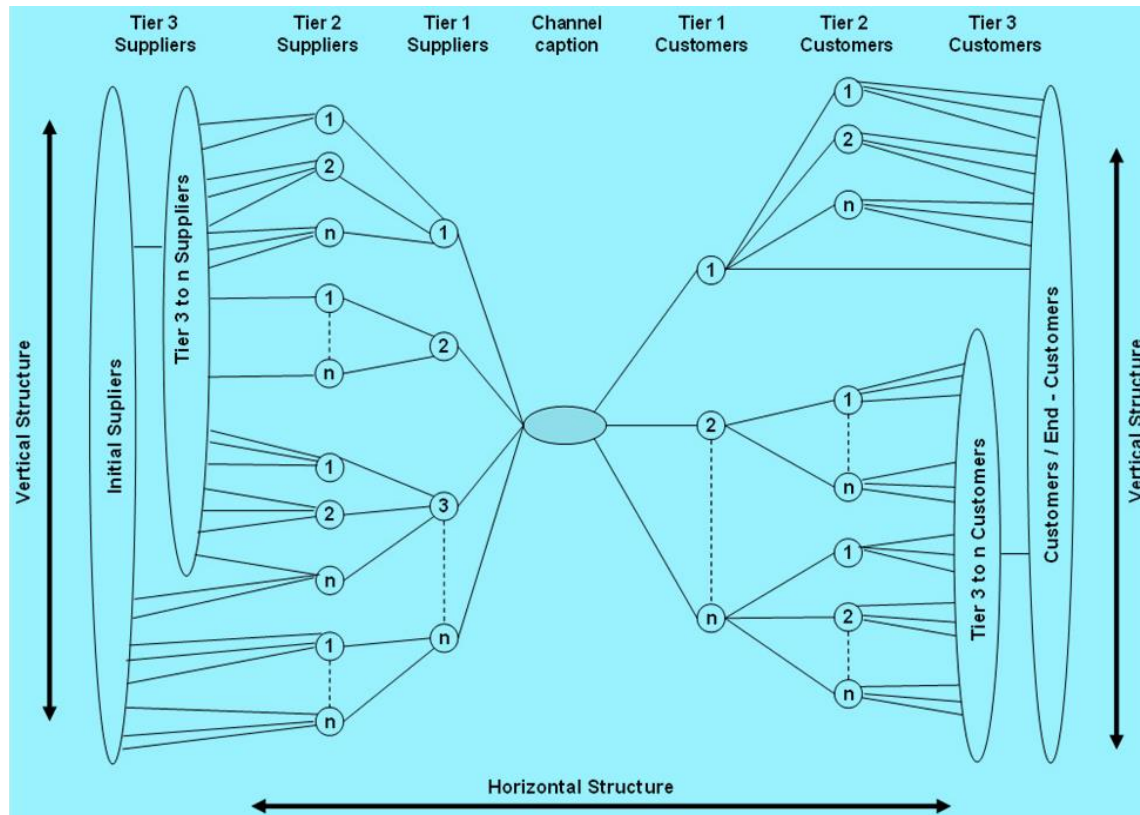


Figure 1.6 Supply chain around a manufacturer

It is quite easy to visualize the figure of a manufacturer's supply chain, but the majority organisations use the similar general approach. Airlines, for instance, shift passengers from pick-up points, through local feeder services to chief 'hub' airports, on to another hub, and then back out via local services to their destinations; banks collect all cheques in central clearing houses prior to sending them back to branches and customers; blood transfusion services have local centres that act as wholesalers for plasma. Every product has its own supply chain, and there are so many different configurations. Some are very small and simple – like a cook purchasing potatoes straight from a farmer. Others are astonishingly long and complex. A daily routine product like a shirt has an extensive trip from the farm growing cotton through to the end consumer. It also has a number of chains merging as buttons, dyes, polyester, and other materials connect the major process.

Supply chains deviates to take the demand from dissimilar types of consumer. Manufacturers of car components, for instance, sell some products to car assemblage plants, some to wholesalers for garages doing repairs, some to retail shops for customers, and some directly to customers via websites. Then, the supply chain split into divided strands with the same product following different routes.

Benefits of Supply Chains

Supply chains are so complex that you may doubt if there is some means of avoiding them. Sometimes, this is feasible, when we shift products directly from primary producers to final consumers – when, for instance, farm shops sell vegetables straight to consumers, or authors who issue their works on the Internet. In general, there are very fine reasons for having an extended supply chain. Suppose the residents of a town decide to purchase vegetables from a farm shop. This would have a negligible supply chain, but the entire population would travel alone to the farm. It would make more logic to have a transport business for collecting the vegetables and delivering them to a middle location in the town – like a supermarket. If the transport business delivers to one town, without difficulty it can deliver to other nearby towns as well, maybe by stopping at a depot to arrange local deliveries. As there is a depot, vegetables can be placed into storage while the supply is abundant, and detached when there are shortages. If the vegetables require cleaning or preparation, the transport business can redirect to a processing plant. Continuing in this mode, you can observe why a long supply chain expands, and what profits it brings.

Supply chains are developed to beat the gaps, which are formed when suppliers are some distance away from consumers. They permit for operations that are best completed – or can simply be done – at locations that are far-away from sources of materials or customers. For instance, coffee beans are cultivated in South America, but the major consumers are in Europe and North America. The most excellent locations for power stations are away from both their major customers in cities and their fuel supplies.

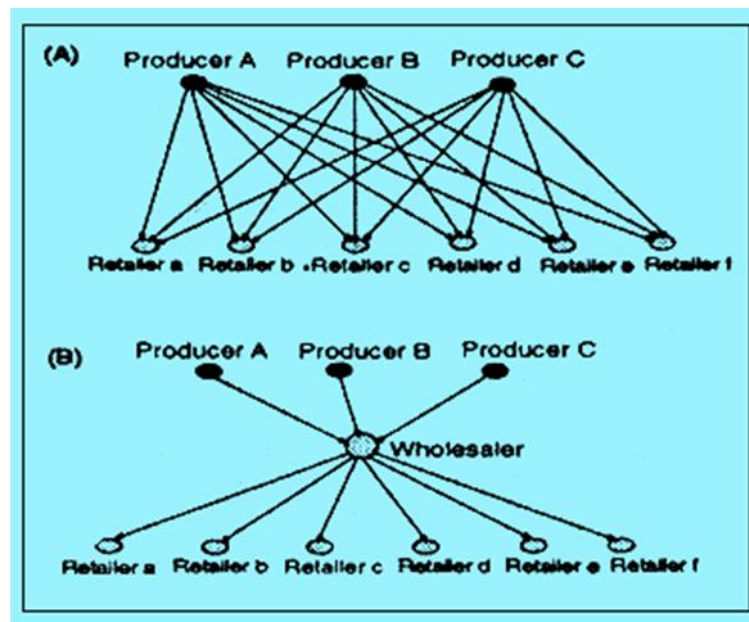


Fig: 1.7

Visualize four factories directly delivering products to eight consumers. Logistics has to systematize 32 diverse delivery routes, however, if the factories employ a central wholesaler, the number of routes can be cut to 12. The following list puts forward some other benefits of elegant supply chains (where we apply the terms 'wholesaler' and 'retailer' as a suitable label for intermediaries):

- Producers place operations in the finest locations, regardless of the locations of their consumers.
 - By focused operations in big facilities, producers can obtain economies of scale.
 - Producers do not maintain huge stocks of finished goods, as these are detained further down the supply chain closed to customers.
 - Wholesalers put big orders, and producers pass on lesser unit costs in price discounts.
 - Wholesalers maintain stocks from a lot of suppliers, giving retailers an alternative of goods.
 - Wholesalers are close to retailers and have little lead times.
 - Retailers take lesser stock as wholesalers offer reliable deliveries.
 - Retailers can have minute operations, giving a reactive service close to customers.
 - Transport is simpler, larger and fewer deliveries reducing costs.
- Organisations can expand expertise in particular kinds of operation.

There is a fundamental outline related to the practice of Supply Chain Management. Every supply chain has its own exclusive set of market demands and working challenges and yet the issues remain fundamentally identical in each case. Businesses in any supply chain must take decisions individually and jointly concerning their actions in the following five areas:

1. **Production** —what products does the market demand? How much of which products should be manufactured and by when? This activity comprises of the formation of master production schedules that consider plant capacities, quality control, workload balancing, and equipment preservation.
2. **Inventory** —what inventory should be placed in stock at every phase in a supply chain? How much stock should be held as raw materials, semi finished, or finished goods? The main reason of inventory is to act as a cushion against ambiguity in the supply chain. However, holding inventory can be costly, so what are the best inventory levels and reorder points?
3. **Location** —where should production facilities and inventory storage space be located? Where are the most inexpensive locations for production and for storage of stock? Should present facilities be used or new ones established? Once these decisions are made, they decide the potential paths which are accessible for products to flow through for delivery to the final customer
4. **Transportation** —how should stock be flown from one supply chain site to another? Air freight and truck delivery are usually fast and consistent but they are costly. Shipping by sea or rail is much less costly but generally involves longer transit times and more doubt. This doubt must be

remunerated for by stocking higher levels of inventory. When is it better to utilize which form of transportation?

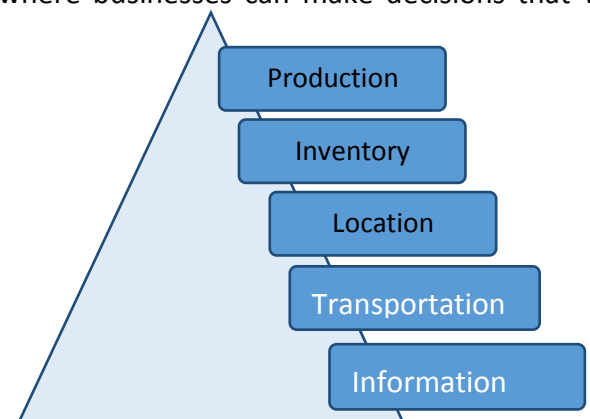
5. **Information** —how much data should be gathered and how much information is to be shared? Timely and accurate information holds the guarantee of better coordination and better decision making. With fine information, people can make effective decisions concerning what to make and how much, about where to place inventory and how best to transfer it.

All these decisions will describe the effectiveness and capabilities of a company's supply chain. The things a business can do and the ways that it can struggle in its markets are all very much reliant on the success of its supply chain. If a company's policy is to serve a mass marketplace and fight on the basis of price, it had better have a supply chain that is optimized for lowest possible cost. If a company's strategy is to supply a market segment and fight on the basis of consumer service and expediency, it had better have a supply chain optimized for receptiveness. What is a business? What can a business do? This is shaped by its supply chain and by the markets it caters.

How the Supply Chain Works

As we saw in the earlier section, there are five areas where businesses can make decisions that will describe their supply chain capabilities:

- Production
- Inventory
- Location
- Transportation
- Information



Chopra and Meindl describe these areas as performance drivers that can be run to generate the capabilities required for a given supply chain.

Effectual Supply Chain Management calls first for a thoughtfulness of every driver and how it operates. Every driver has the skill to directly influence the supply chain and allow certain capabilities. The next step is to expand an approval for the results that can be acquired by mixing diverse combinations of these drivers. Let's begin by looking at the drivers individually.

Production

Production refers to the capability of a supply chain to create and store products. The facilities of production are warehouses and factories. The basic decision that managers encounter when making

manufacturing decisions is how to decide the trade-off between efficiency and responsiveness. If warehouses and factories are constructed with a lot of surplus capacity, they can be extremely flexible and react quickly to broad swings in product demand. Whereas the facilities where approximately all capacity is being used already they are not able to responding easily to variations in demand. On the other hand, capacity costs cash and surplus capacity is inactive capacity not in use and not producing revenue. So the more surplus capacity that exists, the less well-organized the operation becomes. Factories can be constructed to house one of two approaches to manufacturing:

1. **Product Focus** —a factory that focuses on a product performs the variety of diverse operations necessary to make a given product line from production of diverse product parts to assembly of these parts.
2. **Functional Focus** —a functional approach focuses on performing only a few operations like simply making a select collection of parts or only doing assembly. These functions can be performed for making a lot of different types of products.

A product approach aims to result in developing skills regarding a given set of products at the cost of expertise regarding any specific function. A functional approach usually results in proficiency about particular functions rather than expertise in a given product. Companies need to make a decision which approach or what combination of these two approaches will provide them the ability and expertise they require to best react to consumer demands. As with factories, warehouses also can be built to house diverse approaches. There are three major approaches to utilize in warehousing:

1. **Stock Keeping Unit (SKU) Storage**— in this conventional approach, every kind of product, which is the same, is stocked up together. This is a competent and simple to understand means to hoard products.
2. **Job Lot Storage** —in this method, all kinds of different products are associated with the needs of a definite type of consumer or related to the requirements of a particular job are stored together. This permits for a well-organized picking and packing process but generally requires more storage room than the conventional SKU storage approach.
3. **Cross docking** — an approach that was founded by Wal-Mart in its drive to boost efficiencies in its supply chain. In this method, the product is not really warehoused in the facility. In its place the facility is deployed to house a procedure where trucks from suppliers enter and unload huge quantities of dissimilar products. These large lots are then broken down into smaller lots. Smaller lots of dissimilar products are recombined according to the requirements of the day and rapidly loaded onto outbound trucks that carry the products to their end destination.

Inventory

Inventory is spread throughout the entire supply chain and consists of everything from raw material to work in process to finished goods that are detained by the manufacturers, distributors, and retailers in a supply chain. Again, administrators must choose where they want to place themselves in the trade-off between efficiency and responsiveness. Holding large sum of inventory allows a business or a whole supply chain to be extremely responsive to variations in customer demand. However, the formation and storage of stock is a cost and to attain high levels of efficiency, the outlay of inventory should be reserved as low as possible. There are three essential decisions to make concerning the creation and holding of stock:

1. **Cycle Inventory** —this is the quantity of the inventory, which is required to satisfy demand for the product in the time between purchases of the product. Companies tend to manufacture and to buy in large lots in order to increase the benefits that economies of scale can carry. However, with big lots also come improved carrying costs. Carrying costs come from the expenditure to store, handle, and indemnify the inventory. Managers face the trade-off between the decreased cost of ordering and superior prices offered by purchasing product in big lots and the augmented carrying cost of the cycle stock that comes with purchasing in large lots.
2. **Safety Inventory** —this is the inventory that is held as a cushion against ambiguity. If the demand needs are made with perfect accuracy, then the only inventory that would be required would be cycle inventory. But as each forecast has some level of uncertainty in it, we wrap that uncertainty to a greater or lesser quantity by holding further inventory in case demand is unexpectedly greater than predictable. The trade-off here is to consider the costs of carrying additional inventory against the costs of losing sales because of having insufficient inventory.
3. **Seasonal Inventory** —this is inventory, which is stocked up in expectation of expected increases in demand, which occurs at certain times of the year. For instance, it is expected that demand for antifreeze will rise in the winter. If a business that manufactures antifreeze has a permanent production rate that is costly to change, then it will try to produce product at a stable rate all year long and build up supply during periods of low demand to cover for periods of high demand that will go beyond its production rate. The alternative to maintaining a seasonal inventory is to invest in flexible manufacturing facilities that can quickly change their rate of production for different products in response of increase in demand. In this case, the trade-off is between the cost of having seasonal inventory and the cost of having more stretchy production capabilities.

Location

Location means the geographical setting of supply chain facilities. It also consists of decisions that are related to the activities that should be carried out in every facility. The efficiency versus responsiveness trade-off here is the choice whether to consolidate activities in fewer locations to expand economies of scale and efficiency, or to distribute activities in several locations close to consumers and suppliers in order for operations to be more receptive.

When making location based decisions, managers are required to consider various factors that relate to a given site including the cost of facilities, labour cost, skills available in the workforce, transportation conditions, taxes and tariffs, and the nearness to suppliers and consumers.

Location decisions are fairly strategic decisions as they involve large amounts of money to long-term plans. Location decisions have powerful impacts on the performance and cost of characteristics of a supply chain. Once the number, size, and location of facilities are determined it also helps in defining the number of feasible paths through which products can run on the way to the end customer. Location decisions depict a company's fundamental strategy for building and delivering its products to market.



Fig: 1.8

Transportation

This represents the movement of everything, from raw material to completely manufactured goods, between various facilities in a supply chain. In transport, the trade-off between efficiency and responsiveness is manifested in the selection of transport form. Fast means of transport like airplanes are very reactive but also more expensive. Slower modes like ship and rail are very inexpensive but not

as receptive. Since transportation costs can be as much as a third of the operating cost of a supply chain, decisions made here are very significant.

There are six critical modes of transport that a business can pick from:

1. **Shipping** is very cost effective, but, at the same time, it is the slowest means of transport. It is restricted to use between sites that are located next to crossable waterways and facilities like canals and harbours.
2. **Rail** is a very cheap mode but can be slow. This is also restricted to be utilized between locations that are served by rail lines.
3. **Pipelines** can be very flourishing but are inadequate to merchandise that are gases or liquids such as water, natural gas, or oil.
4. **Trucks** are moderately rapid and highly flexible means of transport. Trucks can go about anywhere. The cost of this mode is subject to variations though, as the outlay of fuel fluctuates and the state of roads varies.
5. **Airplanes** are extremely rapid means of transport and are quite responsive. This is also the most luxurious mode and it is rather limited by the accessibility of suitable airport facilities.
6. **Electronic Transport** is the fastest means of transport and it is really cost efficient and flexible. Though, it can only be utilized for flow of particular kinds of products like electric energy, data, and products made up of data such as, pictures, music, and text. Someday, technology that permits us to convert matter to energy and back to matter again might fully rewrite the theory and application of supply chain management.

With these available means of and the site of the facilities in a supply chain, supervisors need to plan routes and networks for making products flow. A route is the course through which products shift and networks consist of the group of the paths and facilities connected by those paths. As a universal rule, the higher the worth of a product (like electronic parts or pharmaceuticals), the more its transport system should highlight responsiveness and the lower the worth of a product (like bulk commodities e.g. grain or lumber), the more its system should stress efficiency.

Information

Information is the foundation upon which to make decisions concerning the other four supply chain drivers. It is the link between all of the operations and activities in a supply chain. To the degree this link is a strong one (i.e., the data is precise, well-timed, and complete), the companies in a supply chain will each be able to make fine decisions for their own operations. This will also be inclined to get the utmost profitability of the supply chain as a whole. This is the way stock markets and other free markets function and supply chains have a lot of the same dynamics as markets.

Information is utilized for two purposes in organization's supply chain:

1. **Coordinating Daily Activities** are related to the implementation of the other four main supply chain drivers:

- Production
- Inventory
- Location
- Transportation

The organizations in a supply chain utilize accessible data on product supply and demand to make a decision on weekly inventory levels, production schedules, transportation passages, and stocking sites.

2. **Forecasting and Planning** to foresee and convene future demands. Available information is utilized to make planned forecasts to guide the situation of monthly and quarterly production schedules and timetables. Information is also utilized for strategic forecasts to direct decisions regarding whether to construct new facilities, enter a new market, or leave a present market.

The Evolving Structure of Supply Chains

The participants in a supply chain are constantly making decisions that influence how they administer the five supply chain drivers. Every organization tries to exploit its performance in dealing with these drivers through a blend of outsourcing, partnering, and internal expertise.

In the fast-moving markets of our current economy, a company generally will emphasize on what it considers to be its major competencies in Supply Chain management and contract out the rest. This was not always the case although. In the slower-moving mass markets of the manufacturing age it was ordinary for winning companies to try to own much of their supply chain. That was termed as vertical integration. The plan of vertical integration was to gain greatest efficiency through economies of scale.

Old Supply Chains versus New

Vertically integrated businesses serving slow-moving mass markets once tried to own much of their supply chains. Today's speedily moving markets need more flexible and receptive supply chains.

Old Supply Chain

Raw Material



Transportation



Manufacturing



Distribution



Retail Showroom



Slow-Moving,
Industrial
Mass Market

New Supply Chain

Raw MaterialsCompany



TransportationCompany



ManufacturingCompany



IndependentDistributor



IndependentRetailer



Fragmented,
Fast-Moving

This was a money-making scheme of doing the trade in the more expected, one-size-fits-all industrial market that existed in the beginning of 1900s. Ford and other businesses churned out mass quantities of basic products. But as the markets expanded and consumers became more conscious about the type of products they wanted, this form started to break down. It could not be open enough or create the range of products that were being demanded.

Globalization, highly spirited markets, and the fast pace of the technological revolution are driving the growth of supply chains where manifold companies work jointly, every company focusing on the activities that it can do best. Mining companies stress on mining, timber companies emphasize on sorting and making lumber and manufacturing companies pay attention to different kinds of manufacturing from making basic parts to doing complete assembly. This way people in every company can keep up with quick rates of change and keep developing the new skills required to work in their particular business.

Companies once regularly ran their own warehouses or run their own trucks' fleet, they now have to think whether those processes are really a core skill or whether it is cheaper to outsource those operations to other businesses that make logistics as their core business. To attain high levels of operating competence and to keep up with ongoing changes in technology, companies are required to focus on their central competencies. It requires this type of focus to stay aggressive.

In spite of vertical integration, businesses now perform "virtual integration."

Companies locate other companies whom they can work with to carry out the activities called for in their supply chains. How a business defines its centre competencies and how it positions itself in the supply a chain it serves is one of the most significant decisions the business makes.

Participants in the Supply Chain

In any given supply chain, there is some blend of companies who carry out different functions. There are businesses who are producers, distributors or wholesalers, retailers, and businesses or individuals who are the customers, the final consumers of a product.

Producers

These are the organizations that make a product. This includes businesses that are producers of raw materials and corporations that are makers of finished goods. Producers of raw materials are businesses that drill for oil and gas, mine for minerals, and cut timber. It also consists of organizations that raise animals, farm the land, or catch seafood. Producers of finished goods utilize the raw materials and subassemblies produced by other producers to make their products.

In any supply chain, there is a variety of companies who perform different functions. Producers can make products that are not tangible items like music, software, entertainment, or designs. A product may also be a service like mowing a lawn, cleaning an office, performing surgery, or teaching a skill. In a lot of instances the producers of tangible, industrial products are shifting to areas of the world where there is costly labour. Producers in the developed world of Europe, North America, and parts of Asia are increasingly producers of non tangible items and services.

Distributors

Distributors are businesses that take inventory in mass from producers and supply a bundle of associated product lines to consumers. Distributors are termed as wholesalers. They usually sell to other businesses and they sell products in bigger quantities than an individual customer would generally buy. Distributors cushion the producers from variations in product demand by stocking inventory and doing a lot of sales work to discover and service consumers. For the consumer, distributors complete the “Time and Place” function—they supply products when and where the consumer wants them.

A distributor is normally a business that takes possession of important inventories of products that they purchase from producers and sell to customers. In addition to product advertising and sales, other functions the distributor carries out are inventory administration, warehouse operations, and product transportation along with customer support and post-sales service. A distributor may also be a business that only brokers a product between the manufacturer and the consumer and never takes possession of that product. This type of distributor performs mostly the functions of product advertising and sales. In both these cases, as the requirements of customers develop and the range of obtainable products changes, the distributor is the mediator that repeatedly tracks consumer needs and aligns them with products available.

Retailers

Retailers stock inventory and sell in lesser quantities to the common public. This business also closely tracks the demands and preferences of the consumers that it sells to. It advertises to its consumers and often utilizes some blend of price, service, convenience and product selection, as the primary draw to attract consumers for the products it sells. Discount department stores draw customers using price and extensive product selection. Upscale specialty stores suggest an exclusive line of products and high levels of service. Fast food hotels use ease and low prices as their draw.

Customers

Customers are any organization that buys and consumes a product. A customer organization might buy a product in order to integrate it into another product that they in turn sell to other consumers. A consumer maybe the final end - user of a product who purchases the product, who consumes it.

Service Providers

These are groups that offer services to producers, distributors, retailers, and consumers. Service providers have come up with special expertise and skills that emphasize on a specific activity required by a supply chain. Because of this, they are capable to carry out these services more successfully and at a superior price than producers, distributors, retailers, or customers could do on their own.

Some general service providers in any supply chain are those providers of warehousing services and transportation services. These are trucking businesses and public warehouse companies and they are termed as logistics providers. Financial service providers deliver services like making loans, gathering past due invoices and doing credit investigations.

These are banks, credit rating companies, and collection agencies. Some service providers deliver market research and advertising, while others provide product design, engineering services, legal services, and management advice. Still other service providers offer information technology and data collection services. All these service providers are integrated to a greater or lesser degree into the ongoing operations of the producers, distributors, retailers, and consumers in the supply chain. Supply chains consist of repeating sets of participants that fall into one or more of these categories. Over all need of the supply chain as a whole remains fairly constant. What changes is the mix of contributors in the supply chain and the roles that each contributor performs.

In some supply chains, there are only few service providers because most of the participants of the supply chain perform these services on their own and they do not need to outsource these services, while others prefer to hand over these services to specialised professionals instead of performing them by themselves.

Further Reading:

- ✓ *James B. Ayers, (2006), Handbook of Supply Chain Management, Second Edition*
- ✓ *Lawrence D. Fredendall, Ed Hill, (2001), Basics of Supply Chain Management*
- ✓ *William C. Copacino, (1997), Supply Chain Management: The Basics and Beyond*