

SYLLABUS

Class: - B.B.A. IV Semester

Subject: - Supply Chain Management

UNIT - I	Development of SCM concepts and Definitions – key decision areas – strategic. Supply Chain Management and Key components, External Drivers of Change. Dimensions of Logistics – The Macro perspective and the macro dimension – Logistic system analysis.
UNIT - II	Sourcing strategy: Manufacturing management – make or buy decision – capacity management – Materials Management – choice of sources – procurement planning.
UNIT - III	Distribution strategy: Choice of Market – network design – warehouse designed operation and distribution planning – transportation – packaging.
UNIT - IV	Inventory Strategy: Demand forecasting – inventory planning – planning of stocking facilities – warehouse location allocation. Warehouse design and operations – inventory norms.
UNIT - V	Channels of Distribution – Customer Service Strategy: Identification of Service needs, cost of services – revenue Management.

UNIT- 1

Course: Development of SCM concepts and Definitions – key decision areas – strategic Supply Chain Management and Key components, External Drivers of Change. Dimensions of Logistics – The Macro perspective and the macro dimension – Logistic system analysis.

Introduction to supply chain Management

- 1) The network created amongst different companies producing, handling and/or distributing a specific product is called supply chain. Specifically, the supply chain encompasses the steps it takes to get a good or service from the supplier to the customer. Supply chain management is a crucial process for many companies, and many companies strive to have the most optimized supply chain because it usually translates to lower costs for the company. Quite often, many people confuse the term logistics with supply chain. In general, logistics refers to the distribution process within the company whereas the supply chain includes multiple companies such as suppliers, manufacturers, and the retailers.
- 2) Supply chain management (SCM) is the management of the flow of goods. It includes the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption. Interconnected or interlinked networks, channels and node businesses are involved in the provision of products and services required by end customers in a supply chain.
- 3) Supply chain management has been defined as 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.

Stages/ Key components in supply chain management

Supply chain management (SCM) is a process used by companies to ensure that their supply chain is efficient and cost-effective. A supply chain is the collection of steps that a company takes to transform raw components into the final product. The following are five basic components of SCM.

- Plan
- Develop (Source)
- Make
- Deliver
- Return.

1) Plan

The first stage in supply chain management is known as plan. A plan or strategy must be developed to address how a given good or service will meet the needs of the customers. A significant portion of the strategy should focus on planning a profitable supply chain.

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) Develop (Sourcing/ suppliers)

Develop is the next stage in supply chain management .It involves building a strong relationship with suppliers of the raw materials needed in making the product the company delivers. This phase involves not only identifying reliable suppliers but also planning methods for shipping, delivery, and payment.

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. And then, 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 (production and operations)

At the third stage, make, the product is manufactured, tested, packaged, and scheduled for delivery. 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) Delivery (distribution/ logistics)

Then, at the logistics phase, customer orders are received and delivery of the goods is planned. This fourth stage of supply chain management stage is aptly named 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 (customer service)

The final stage of supply chain management is called return. As the name suggests, during this stage, customers may return defective products. The company will also address customer questions in this stage.

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.

Key Decision Areas in Supply chain Management

To ensure that the supply chain is operating as efficient as possible and generating the highest level of customer satisfaction at the lowest cost, companies have adopted Supply Chain Management processes and associated technology. Supply Chain Management has three levels of activities that different parts of the company will focus on: strategic; tactical; and operational.

1. Strategic

At this level, company management will be looking to high level strategic decisions concerning the whole organization, such as the size and location of manufacturing sites, partnerships with suppliers, products to be manufactured and sales markets.

Strategic activities include building relationships with suppliers and customers, and integrating information technology (IT) within the supply chain.

2. Tactical

Tactical decisions focus on adopting measures that will produce cost benefits such as using industry best practices, developing a purchasing strategy with favored suppliers, working with logistics companies to develop cost effect transportation and developing warehouse strategies to reduce the cost of storing inventory.

Studying competitors and making decisions regarding production and delivery would fall under the tactical category.

3. Operational

Decisions at this level are made each day in businesses that affect how the products move along the supply chain. Operational decisions involve making schedule changes to production, purchasing agreements with suppliers, taking orders from customers and moving products in the warehouse.

The operational category includes the daily management of the supply chain, including the making of production schedules.

Importance of supply chain management

To remain competitive, small firms have to offer superior quality goods at the lowest prices possible. The need to minimize product costs makes effective supply chain management vital. There are costs involved in every process of the product life cycle, and it is the responsibility of management to ensure that these costs are kept low, so the company can continue to pass along these savings to the consumer.

1. Reduced Costs

Supply chain management involves identifying those processes that increase cost without increasing the

value of the final product. These processes are wasteful and do not add value, and should be eliminated whenever possible.

2. Increased Efficiency

Resource wastage is a common source of increase production costs. Often this is due to improper planning. A company that employs supply chain management is able to achieve efficiency of its operations since only those value adding activities are encouraged. This ensures that the organization's processes flow smoothly and output keeps inline with the company's needs.

3. Increased Output

A company that employs supply chain management can foster close-knit relationships with its suppliers and customers, ensuring the timely fulfillment of orders. A company known for its timeliness and responsiveness will attract more customers, and will grow as a result of increased output and sales.

4. Increased Profits

Businesses exist to make profits. One of the most efficient ways of increasing a company's profits is by ensuring that costs are kept as low as possible. The application of supply chain management by a small company leads to cost reductions due to elimination of wasteful processes. Since these are operating costs for the company, the savings on these costs reflect increased profits by the company.

Pull v/s Push supply chain

Under pull supply chain, products are manufactured or procured based on specific customer requests. We also know it as "Built to Order" or "Configured to Order" model. We often see this model operating in IT/High Tech Industries, where customization is the competitive advantage. Briefly, we have seen this model in automotive industry and it is being used in high end luxury market segment. The objective of this model is to minimize the Inventory carrying and optimize supply. Pull model are is as a response to growing uncertainty in demand and short product cycle. Some of the characteristics of this model include:

1. Volatile demand situation
2. High rate of Customization
3. Minimal Inventory Carrying
4. Not a off the shelf product
5. Highly dynamic and effective distribution network.

Under Push model, products are manufactured or procured based on anticipated customer orders (speculative). This model is also known as Built to Inventory or Built to Stock. The name itself reveals its functionality. Products are manufactured in anticipation of customer needs. There are no prizes for identifying industries that use push model, it is obvious that retail heavily uses push model. Even though direct to store or cross docks are implemented, overall retail supply chain is based on push model. Some of the big names in the retail industry are trying to adopt the hybrid model which is a combination of pull and push. Some of the key challenges and characteristics could include:

1. High inventory costs,
2. Challenging working capital requirements due to low inventory turns;
3. Huge warehousing and distribution costs;
4. Inability to meet dynamic market conditions and
5. Seasonal demand and off the shelf product.

The Bullwhip Effect: definition

The bullwhip effect can be explained as an occurrence detected by the supply chain where orders sent to the manufacturer and supplier create larger variance then the sales to the end customer. These irregular orders in the lower part of the supply chain develop to be more distinct higher up in the supply chain. This variance can interrupt the smoothness of the supply chain process as each link in the supply chain will over or underestimate the product demand resulting in exaggerated fluctuations.

Causes of the Bullwhip Effect

Sources of variability can be demand variability, quality problems, strikes, plant fires, etc. Variability coupled with time delays in the transmission of information up the supply chain and time delays in manufacturing and shipping goods down the supply chain create the bullwhip effect.

The following all can contribute to the bullwhip effect:

1. Overreaction to backlogs
2. Neglecting to order in an attempt to reduce inventory
3. No communication up and down the supply chain
4. No coordination up and down the supply chain
5. Delay times for information and material flow
6. **Order batching** - larger orders result in more variance. Order batching occurs in an effort to reduce ordering costs, to take advantage of transportation economics such as full truck load economies, and to benefit from sales incentives. Promotions often result in forward buying to benefit more from the lower prices.
7. **Shortage gaming**: customers order more than they need during a period of short supply, hoping that the partial shipments they receive will be sufficient.
8. **Demand forecast inaccuracies**: everybody in the chain adds a certain percentage to the demand estimates. The result is no visibility of true customer demand.
9. Free return policies

How to reduce Bullwhip Effect?

While the bullwhip effect is a common problem, many leading companies have been able to apply countermeasures to overcome it. Here are some of these solutions:

1. Countermeasures to order batching - High order cost is countered with Electronic Data Interchange (EDI) and computer aided ordering (CAO). Full truck load economies are countered with third-party logistics and assorted truckloads. Random or correlated ordering is countered with regular delivery appointments. More frequent ordering results in smaller orders and smaller variance. However, when an entity orders more often, it will not see a reduction in its own demand variance - the reduction is seen by the upstream entities. Also, when an entity orders more frequently, its required safety stock may increase or decrease; see the standard loss function in the Inventory Management section.

2. Countermeasures to shortage gaming - Proportional rationing schemes are countered by allocating units based on past sales. Ignorance of supply chain conditions can be addressed by sharing capacity and supply information. Unrestricted ordering capability can be addressed by reducing the order size flexibility and implementing capacity reservations. For example, one can reserve a fixed quantity for a given year and specify the quantity of each order shortly before it is needed, as long as the sum of the order quantities equals to the reserved quantity.

3. Countermeasures to fluctuating prices - High-low pricing can be replaced with every day low prices (EDLP). Special purchase contracts can be implemented in order to specify ordering at regular intervals to better synchronize delivery and purchase.

4. Countermeasures to demand forecast inaccuracies - Lack of demand visibility can be addressed by providing access to point of sale (POS) data. Single control of replenishment or Vendor Managed Inventory (VMI) can overcome exaggerated demand forecasts. Long lead times should be reduced where economically advantageous.

5. Free return policies are not addressed easily. Often, such policies simply must be prohibited or limited.

External Drivers of Supply Chain Performance

Inventory

1. All of the raw materials, work in process (WIP), and finished goods within the supply chain. Inventory policies can dramatically alter a supply chain's efficiency and responsiveness.

2. Why hold inventory?(3 reasons)

- >Unexpected changes in customer demand (always hard to predict, and
- >uncertainty is growing)
- >Short product life cycles
- >Product proliferation
- >Uncertain supply

3. Inventory's Impact Inventory can increase amount of demand that can be met by increasing product availability. Inventory can reduce costs by exploiting economies of scale in production, transportation, and purchasing. Inventory can be used to support a firm's competitive strategy. More inventory increases responsiveness, less inventory increases efficiency (reduces cost).

Transportation

1. Faster transportation allows a supply chain to be more responsive but generally less efficient. Less than full truckloads allow a supply chain to be more responsive but generally less efficient.
2. Transportation can be used to support a firm's competitive strategy. Customers may demand and be willing to pay for a high level of responsiveness.
3. Mode of transportation is the manner in which a product is moved (air, truck, rail, ship, pipeline, electronic). Each mode differs with respect to speed, size of shipments, cost, and flexibility.
4. Routes are paths along which a product can be shipped.
5. In house or outsource the transportation function. Many companies use third-party logistics providers (3PL) to perform some or all of their transportation activities.

Facilities

1. Places within the supply chain where inventory is stored, assembled, or fabricated. Decisions on location, capacity, and flexibility of facilities have a significant impact on performance.
2. Facilities Impact: Facilities either store inventory between supply chain stages (warehouses, distribution centers, retailers) or transform inventory into another state (fabrication or assembly plants).
3. Centralization of facilities uses economies of scale to increase supply chain efficiency (fewer locations and less inventory) usually at the expense of responsiveness (distance from customer)
4. Facility Decisions Location: Centralize to gain economies of scale or decentralize to be more responsive. Other issues include quality and cost of workers, cost of facility, infrastructure, taxes, quality of life, etc. Capacity. Excess capacity allows a company to be more responsive to changes in the level of demand, but at the expensive of efficiency.

Information

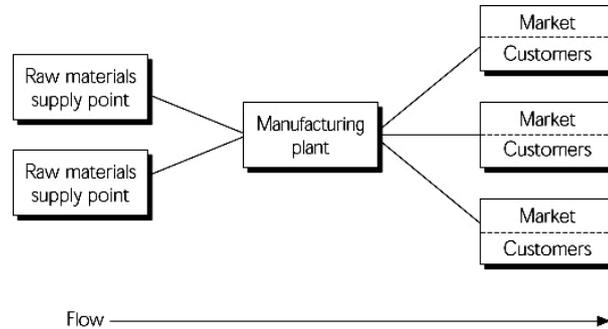
1. Data and analysis regarding inventory, transportation, facilities, and customers throughout the supply chain. It is potentially the biggest driver since it affects all the other drivers.
2. Information's Role: Information connects various supply chain stages and allows them to coordinate activities. Information is crucial to the daily operations of each stage of the supply chain. An information system can enable a firm to get a high variety of customized products to customers rapidly .An information system can enable a firm to understand changing consumer needs more

Dimensions of logistics -Macro Perspective& macro dimension

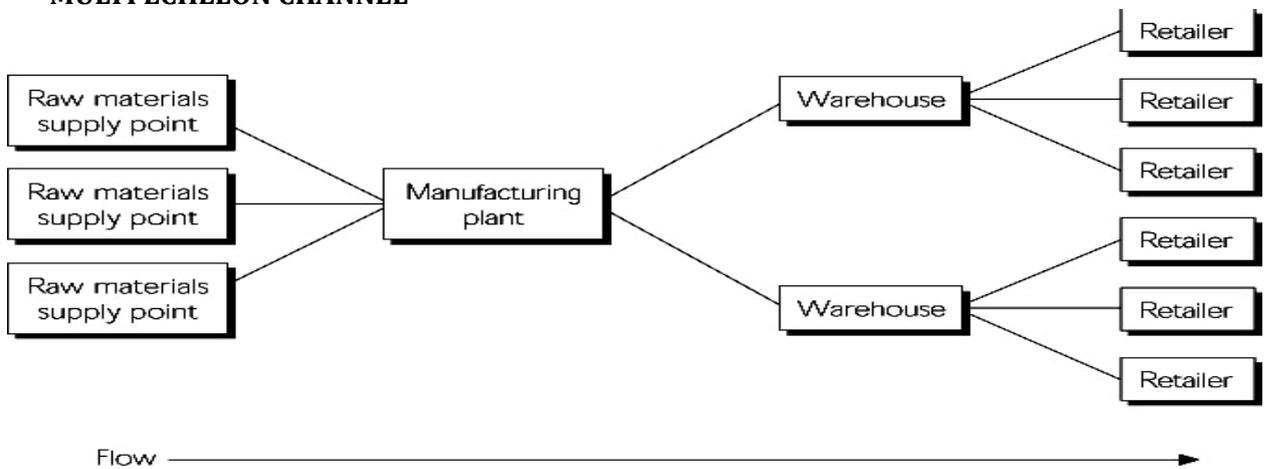
- Logistics impacts and has relationship with economy
- Cost of business logistics increasing
- Percentage of GDP decreasing
- Transportation largest percentage of logistics costs (rising due to inventory management practices)
- Logistics adds value to a product
- Place utility - moving goods to points where demand exists
- Time utility - moving goods to points at a specific time
- Allows for economic development and specialization
- Affects land values due to increased accessibility

LOGISTICS SYSTEM ANALYSIS

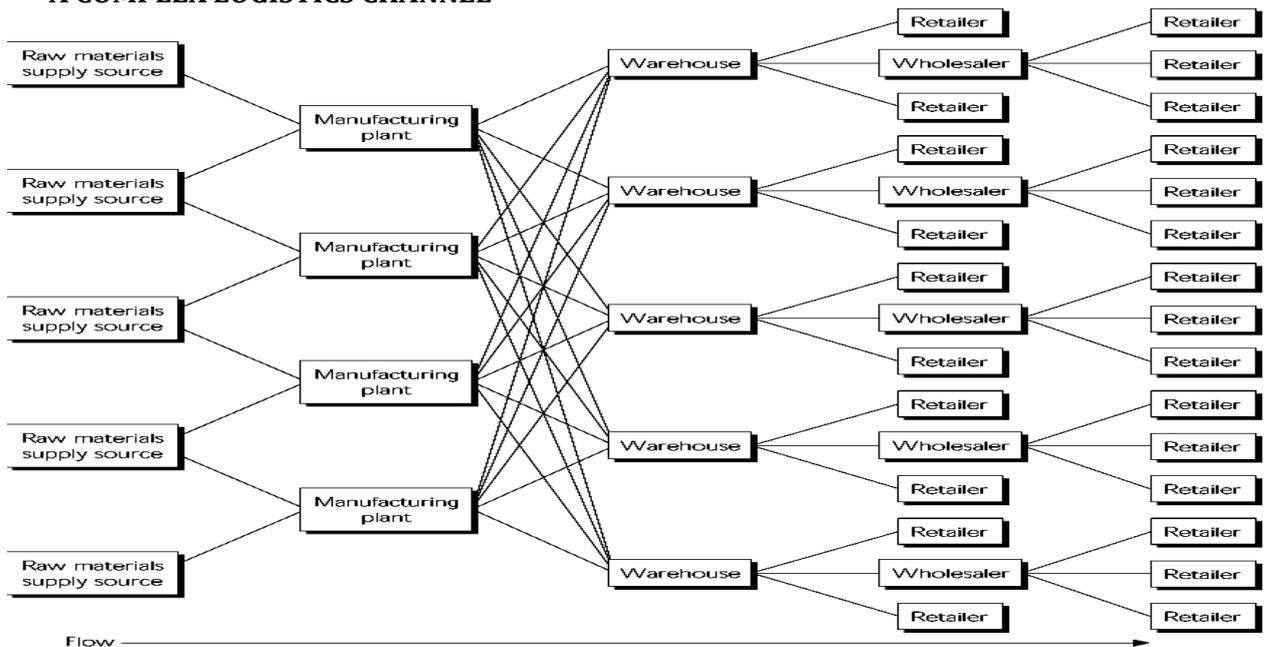
1) SIMPLE LOGISTICS CHANNEL



2) MULTI ECHELON CHANNEL



3) A COMPLEX LOGISTICS CHANNEL



UNIT- 2
SOURCING STRATEGY (SINGLE & MULTIPLE SOURCING)

Strategic sourcing is an institutional procurement process that continuously improves and re-evaluates the purchasing activities of a company. In a production environment, it is often considered one component of supply chain management.

The steps in a strategic sourcing process are:

1. Assessment of a company's current spend (what is bought where?)
2. Assessment of the supply market (who offers what?)
3. Total cost analyses (how much does it cost to provide those goods or services?)
4. Identification of suitable suppliers
5. Development of a sourcing strategy (where to buy what considering demand and supply situation, while minimizing risk and costs)
6. Negotiation with suppliers (products, service levels, prices, geographical coverage, etc.)
7. Implementation of new supply structure
8. Track results and restart assessment (continuous cycle)
9. Negotiate with the vendor about the payments terms of the specific organisation.

When a company decides to outsource, it is typically seeking to achieve one or more of the following:

- Increased cost savings.
- Value for money.
- Better service levels.
- Access to best practices.
- Greater innovation.

Based on the above points a firm may opt for single sourcing or multiple sourcing.

Single sourcing

- 1) In single sourcing the customer chooses a single supplier to provide the entire set of services that it wishes to outsource, and relies on that supplier to carry responsibility for the outsourced services throughout the contract term.
- 2) A single sourcing arrangement generally has the following features:
 - **Responsibility.** The key differentiation between a single sourcing and a multi-sourcing relationship is that the customer can look to the supplier as a single point of failure of service delivery, even where the supplier has subcontracted
 - **Long-term contract.** Historically, single sourcing contracts were lengthy engagements, at times lasting as long as 15 years. However, in recent years single sourced deals have shortened in duration, with most falling within a range of three to seven years for the initial term. As expected, suppliers seek long-term contracts because this gives them more leverage to deliver cost savings and value for money over time to their customers.
 - **Lock-in.** One of the frequent problems with single sourcing can be that the customer is “locked in” to its supplier. This can have disadvantages: the supplier controls its subcontractors, and is often more concerned with protecting its own margins. Therefore, customers often find it difficult to create any sense of competition around the award of new services in a single sourcing.
- 3) **Advantages of single sourcing are:**
 - Suppliers can enjoy economies of scale. This results in decreased costs and able to fulfill any extra demand beyond normal demand
 - Buyers often get quantity discounts from the suppliers
 - Increased cooperation and communication in the buyer supplier relationship
 - Accelerated learning curve means that supplier becomes proficient in manufacturing the component that it is supplying, this results in decreasing manufacturing time per unit.

4) Disadvantages of single sourcing:

- A single point of failure of supplier results in disruption of the whole production of the buyer.
 - Supplier could increase prices because it is the only supplier and no other supplier is capable of supplying the required component.
 - If everyone reduces their supplier base, there will be fewer suppliers and less competition in the long-term and this not good from the market point of view because this creates monopoly.
- 5) Over 98% of Ford's outsourced parts are supplied by single-source suppliers

Multi-sourcing

- 1) In multi-sourcing, the customer enters into separate, parallel agreements with different suppliers for different parts of the services to be outsourced.
- 2) A multi-sourcing structure generally has the following features:
 - **Choice and flexibility.** In contrast to single sourcing, multi sourcing involves competition between suppliers, and avoids lock-in to a single supplier for a broad range of services for a long period of time
 - **Responsibility.** The customer's operational risk is higher than in a single sourcing because it delegates responsibility to several suppliers. This interaction with different parties can make it harder to strike the right deal and ensure that the separate contracts are properly implemented.
- 3) **Advantages of multiple sourcing:**
 - Competition will drive down costs
 - Undisrupted supply if something goes wrong with one supplier
 - Buyers may have more bargaining power
- 4) **Disadvantages of multiple sourcing:**
 - More suppliers to manage
 - Slower learning curve
 - With orders spread over multiple suppliers, buyers may not get quantity discounts

Cross-Sourcing

- 1) The single vs. multiple sourcing decisions does not have to be mutually exclusive. A hybrid approach can be used that is known as cross sourcing .Dross sourcing expands the supplier base without increasing the actual number of suppliers.
- 2) Cross-sourcing works this way: Supplier and B can both produce parts 1, 2, 3, 4, and 5. The advantages of both single and multiple sourcing can be achieved if supplier A produces of parts 1, 3, and 5 and supplier B produces parts 2 and If anything happens to supplier, supplier can pick up the slack as it has the capability to produce 1, 3, and 5 as well Neither supplier suffers because overall volume remains the same

MATERIALS MANAGEMENT

Definition

- 1) Materials management is the branch of logistics that deals with the tangible components of a supply chain. Specifically, this covers the acquisition of spare parts and replacements, quality control of purchasing and ordering such parts, and the standards involved in ordering, shipping, and warehousing the said parts.
- 2) **Materials management** can deal with building design for the movement of materials, or with logistics that deal with the tangible components of a supply chain. Specifically, this covers the acquisition of spare parts and replacements, quality control of purchasing and ordering such parts, and the standards involved in ordering, shipping, and warehousing the said parts

Goal: The goal of materials management is to provide an unbroken chain of components for production to manufacture goods on time for the customer base. The materials department is charged with releasing materials to a supply base, ensuring that the materials are delivered on time to the company using the correct carrier. The materials department is also charged with the responsibility of managing new launches.

Objectives of materials management

Materials Management has several core objectives and many secondary objectives. The core objectives of material management are:

- Proper, cost effective material procurement.
- Proper storage of materials so as to minimize wastages and material holdups.
- Making available the material TIMELY.
- A good material management system will keep up to data records of all the information generated in it, preferably using a computer-based system.

In addition to these primary objectives a materials management system indirectly fulfills many secondary objectives also. These secondary objectives are normally related to the functions of a material management system. Some of these secondary objectives are:

- Identifying new or better sources of supply
- Development and sustenance of relationships with the vendors
- Creating a standardized quality of the products
- Performing the value analysis of inventory. This can be related to the cost of materials.
- Creating a smooth flow of materials and information among the various sections of materials management system.

The material management system works under the broad basic objectives of an organization that is “maximum profit with sustained growth and research, satisfied customers and staff of the organization”. The material management supports this objective by providing support through:

- Continuity of supply by maintaining a uniform flow of materials,
- Reducing the costs of materials purchased and handling by using scientific techniques and electronic tools. The use of scientific tools and techniques for materials and information management,
- Minimizing holdups of working capital and performing effective inventory control
- Releasing working capital by ensuring effective control over inventories
- Providing high quality at the lowest price, and
- Development of better relationships with customers and suppliers.

Advantages of Materials Management:

Material management has created a niche in many organizations, which have implemented the integrated materials management. These organizations usually enjoy the following advantages:

- Better accountability on part of materials as well as other departments as no one can shift blame to others.
- As materials management is handled by single authority, it can result in better coordination, as it becomes the central point for any material related problems.
- Materials management department makes sure that better quality material is supplied timely to the requesting departments. This can result in better performance of the organization.
- A materials management system is typically controlled through an information system, thus, can help in taking decisions related to material in the organization.
- One indirect advantage of material management is that good quality material develops the ethical and moral standard in an organization.

Scope of Materials Management

Although the scope of a material management system is vast, yet we can define the following functions as its scope functions:

- 1) **Material Planning and Controlling:** One of the key functions that identify the scope of the materials management is the materials planning and control. This function is based on the sales forecast and the production plans of an organization. The activities of this function are:
 - Forecasting of materials requirements
 - Preparation of materials budget of the organization
 - Estimating the levels of inventories required in the organization
 - Scheduling the orders placed with the vendors to ensure availability of material
 - Controlling by monitoring of production vis a vis sales.
- 2) **Purchasing:** The purchasing is another major function for the materials management. This function contains the following activities:

- Identification and selection of possible Suppliers
- Finalizing the terms and references of purchases that are to be made.
- Placing the purchase orders this activity may be staggered as per the inventory control function.
- Managing the purchase orders till delivery of materials
- Giving clearance to payment of received good; and
- Analyzing the performance of the suppliers and rating them.
- 3) **Stores and Inventory Control:** This function helps in physical control of materials. It has the following list of activities:
 - Minimization of material losses due to obsolescence and handling. This activity controls the timely disposal and efficient handling of materials.
 - Maintenance of stores records along with proper location and stocking of materials.
 - Physical verification of stocks and reconciling.
 - Performing inventory setting and control. Some such activities include performing ABC analysis, fixing economical ordering quantities, identification of selling safety stock levels, performing lead-time analysis etc.

CAPACITY MANAGEMENT

What is Capacity?

- 1) Capacity is the maximum output rate of a facility
- 2) Capacity can be expressed in terms of input & output, depending on the nature of business. Organization Measure For some organization capacity is simple to measure.
- 3) For example:
 - A legal office may express capacity in terms of the number of attorneys employed per year.
 - A custom job shop or an auto repair shop may express capacity in terms of available labour hours and/or machine hours per week, month, or year.
 - Automobile manufacturer- Numbers of autos produced per week/day/hour
 - Steel producer -Tones of steel
 - Power company -Megawatts of electricity
 - Airline -Numbers of seats
 - Hospital -Number of beds
 - Tax office Number of accountants

Capacity Management :

- 1) The function of establishing, measuring, monitoring, and adjusting limits or levels of capacity in order to execute all manufacturing schedules; i.e., the production plan, master production schedule, material requirements plan, and dispatch list is called capacity management
- 2) Capacity management is executed at four levels: resource requirements planning, rough-cut capacity planning, capacity requirements planning, and input/output control.
- 3) **Constraints on capacity** In capacity management there are usually two potential constraints –**TIME** and **CAPACITY**. **Time** may be a constraint where a customer has a particular required delivery date. In this situation, capacity managers often "plan backwards".

Areas of capacity Management

A company should develop its capacity management program in the following crucial areas:

- 1) **R&D Capacity:** This is very essential for development of new products.
- 2) **Production Capacity:** to meet the growing demands of market and to fulfill seasonal demand surges.
- 3) **Service capacity:** To enhance the service levels to meet the growing demand of the customers.
- 4) **Operational Capacity:** To meet the operational requirements of the growing production.

Capacity Planning

- 1) Capacity planning is the process of establishing the output rate that can be achieved at a facility
- 2) "Capacity planning is the process of projecting future capacity needs based on current company use and industry trends. For example, the gradual increase of a production workforce in response to an increase in product demand is capacity planning."

- 3) A company invests significant resources into capacity planning, including the purchase of new equipment and the leasing of new facilities. Understanding the advantages of capacity planning can help justify the costs.

Steps in Capacity Planning

- 1) **Determine Service Level Requirements:** The first step in the capacity planning process is to categorize the work done by systems and to quantify users' expectations for how that work gets done.
- 2) **Analyze Current Capacity:** Next, the current capacity of the system must be analyzed to determine how it is meeting the needs of the users.
- 3) **Planning for the future** Finally, using forecasts of future business activity, future system requirements are determined. Implementing the required changes in system configuration will ensure that sufficient capacity will be available to maintain service levels, even as circumstances change in the future.

The Advantages of Capacity Planning

- 1) **Monitor Costs:** Capacity planning takes into account personnel, facilities, production schedules and supplies. When the capacity level is carefully planned, the company can monitor costs during periods of growth and recession.
- 2) **Production Cycle:** Your company can use capacity planning to maintain proper production levels during expected business cycles. For example, if your company traditionally sees an increase in orders during the OCTOBER in anticipation of the Diwali, then you can use historical data to plan production capacity and have ample staff on hand to handle the rise in demand.
- 3) **New Locations :**As your company grows, you may find the need to open new production facilities. Using your capacity planning information from your existing locations, you can develop a more accurate projection of needs for facilities and personnel levels, and of the kind of production that can be expected from the new location.
- 4) **Information:** Your Company accumulates digital information on a daily basis. That information is critical in being able to run your business and maintain profitability. A capacity plan that stays ahead of digital information storage demands and also allows for the permanent archiving of vital information is essential in the efficient growth of your organization.

UNIT - III
DISTRIBUTION STRATEGY
TOPIC: TRANSPORTATION

Transportation is one of the important operations in supply chain management. It is concerned with the movement of goods from one location to another. Transportation is also one of the major sources of cost in the supply chain. With increase competition and high customer expectations, timely and quick delivery of the product has become the norm in the business environment.

FUNCTION OF TRANSPORTATION IN A SUPPLY CHAIN

Transportation performs two important functions – product movement and product storage.

Product Movement

Product movement is the primary function of transportation. Goods – whether they are raw material from suppliers, work-in progress goods from one manufacturing level to another, or finished goods from manufacturer to warehouses and retailers or directly to customers are required to be transported from one level of the supply chain to another. Transportation of goods consumes three types of resources – temporal, monetary, and environment.

1. Temporal resources are the goods that are in transit. These goods are also called in transit inventory. They are inaccessible to the firm during the period of travel.
2. Firms utilize the service of vehicles, personnel, and facilities in the process of transporting goods to various destinations within a supply chain. This requires considerable amount of monetary resources to meet the vehicle operating costs, personnel costs, and other administrative expenses.
3. Transportation also uses environmental resources directly and indirectly. Directly, transportation consumes fuel, which is a non-renewable natural resource. Indirectly, vehicles pollute the environment through noise and air pollution, causing environmental degradation.

Therefore, transportation should concentrate on the movement of goods between various facilities in a supply chain, in a manner that utilizes, minimum resources and provides maximum satisfaction to customers.

Product Storage

A secondary function performed by transportation with a supply chain is a temporary storage. Although using transportation vehicles for temporary storage is a costly option, firms resort to it when their warehouse capacity is limited. In some cases, temporary storage option is advisable when the costs of unloading and loading are more than the additional transportation costs. Firms avail themselves of temporary storage facility by:

1. Using indirect routes for shipping goods
2. Diverting shipments to other destinations.

PARTICIPANTS IN TRANSPORTATION DECISIONS

Understanding the four key participants who are involved in the transportation transactions in a supply chain will aid in decision making. They are

1. The shipper
2. The carrier
3. The receiver or consignee
4. The government

The Shipper and the Consignee

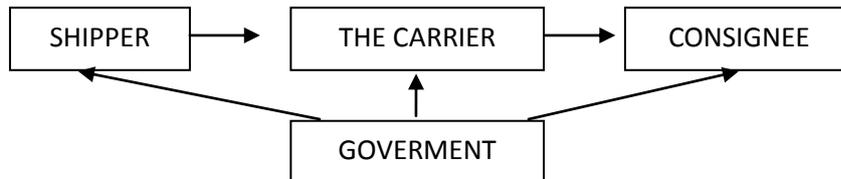
The shipper and the consignee are concerned with the timely delivery of the goods from one point to another. Their objective is to deliver the goods at the destination quickly, and at minimum cost.

The Carrier –

The carrier acts as the intermediary between the shipper and the consignee. He is responsible for the actual movement of goods. The primary motive of a carrier is to maximize the revenue from transportation transactions.

The Government

Transportation plays an important role in the economic growth of any country. Hence, the government has a vested interest in developing the transportation infrastructure to ensure a proper transportation network, that will enable an effective flow of goods. It regulates and controls the transportation network, in order to make the movement of goods faster and at a reasonable cost.



PARTICIPANTS IN TRANSPORTATION DECISION

IMPORTANT OF TRANSPORTATION

Importance/Advantages of Transport. Transportation is significant, useful and valuable for both economic and social point of view. Transportation has the following economic and social advantages.

Economic Advantages of Transport

- (i) **Creation of utilities.** Goods are transported from the place, where its supply is in abundance to place, where they are scarce. This way the utility (wants satisfying capacity) of goods is increased.
- (ii) **Large scale production and expansion of market.** Transport has expanded the market of the commodities. These days, goods may be produced in large scale and sold in the different parts of the world.
- (iii) **Encouragement to localization and specialisation.** Industries tend to localise and centralise at those places, where better transport facilities are available.
- (iv) **Development of Foreign Trade.** Modern improved air and water transport has facilitated movement of goods from one country to another country and thus foreign trade has developed years fast.
- (v) **Development of perishable goods industries.** Perishable goods such as vegetable, fruits, eggs, fish must be consumed at the earliest, otherwise they will perish. Transportation facilities enable their movement to the places, where is scarcity. Consequently perishable goods industries flourish with the development transport facilities.
- (vi) **Mobility of labour.** Due to the developed transport facilities worker can move to the place where they get more wages and better deal.
- (vii) **Stability of prices.** Prices of commodities are more at place where these are scarce. In order to take advantage of the rising prices goods from places of abundance rush to the places of scarcity.

SOCIAL ADVANTAGES OF TRANSPORT

The social advantages of transport are as –

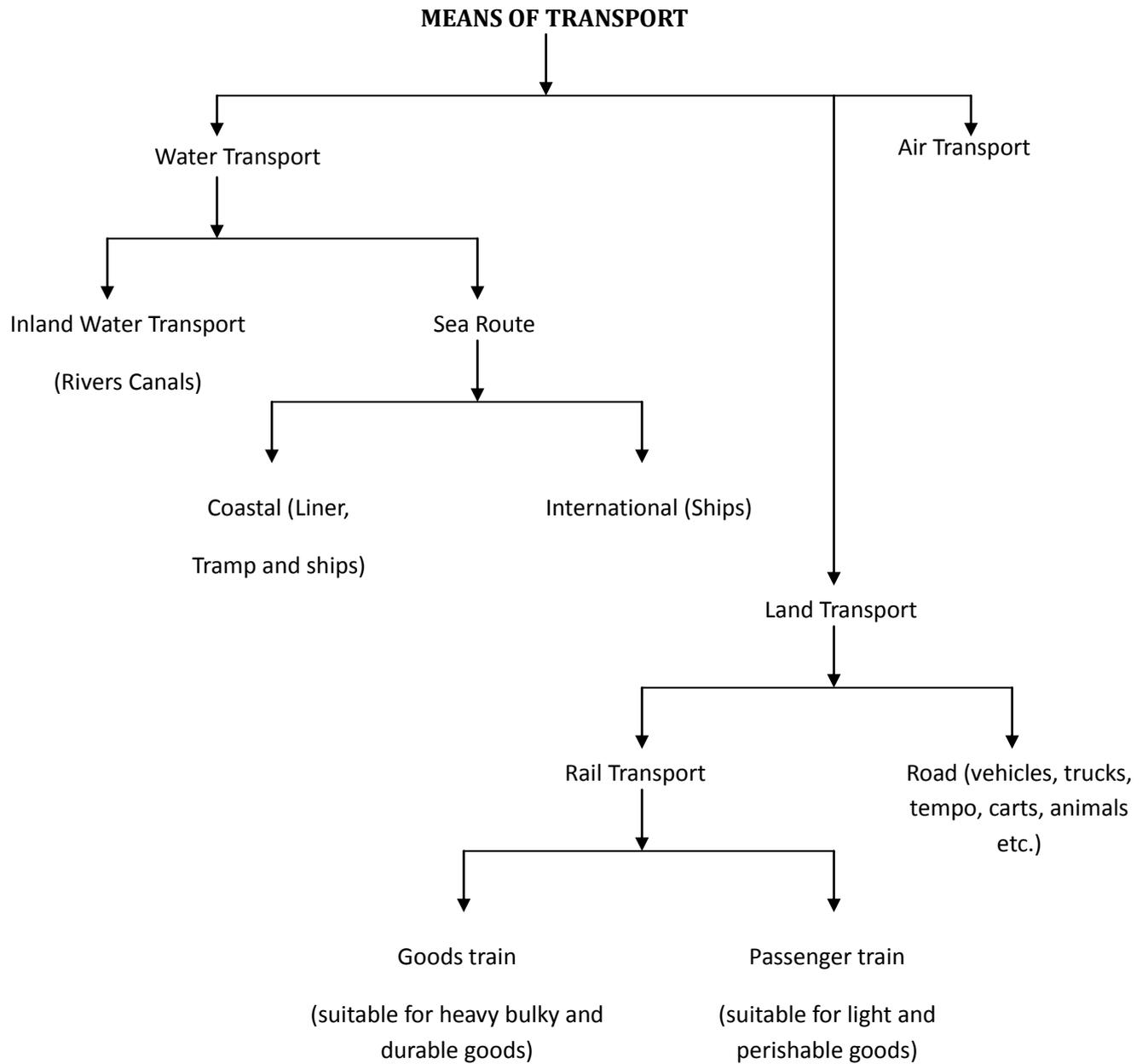
1. **More employment opportunities.** Transport creates employment and also provide employment through helping mobility of workers. About 18 lakhs people are employed in Indian railways.
2. **Social and cultural spirit.** Means of transport brings together persons living at different places. They exchange their views. They have the common problems, because of living together. Consequently social and cultural unity emerges.
3. **Higher standard of living.** Transportation has reduced distance, so we are now in position to use various and variety of things produced in different corners of the world. The use of these standard commodities increases our standard of living.

SIGNIFICANCE OF TRANSPORT IN THE ECONOMIC DEVELOPMENT

An efficient and cheap transport and communication system plays a vital role in economic development of an underdeveloped country.

Significance of good transport and communication system in economic development of a country is clear from the following points:

1. **Movement of Raw Materials, Fuels and Machinery.** With the help of efficient and cheap transportation system raw materials, fuel and machinery etc. can be easily carried to factories, where these are needed.
2. **Increase in Labour Mobility.** The transport and communication system helps in the mobility of labour. As a result unemployed or underemployed labour will get full and remunerative employment.
3. **Extension of markets.** The means of transport and communication broaden the market for goods and services. With increased demand, large scale production becomes possible and we can get all the benefits of large-scale production.
4. **More access to natural resources.** Development of road and rail transport will draw out from the remote and in accessible regions its vast and unexplored natural wealth in the form of minerals, forests and agricultural wealth.
5. **Balance Regional Development.** Transport helps the industries to be developed in different parts of the country.
6. **Commercialization of Agriculture.** Indian agriculture has been commercialized with the development of means of transport. Means of transport have linked the Indian farmers with not only national markets but also with international markets.
7. **Generation of Employment.** With the development of means of transport and communication, additional employment opportunities have been created. Indian Railways have provided job to over 18 lakh persons.



SURFACE/LAND TRANSPORT

Land transport has been classified as rail transport and road transport-

Rail Transport. There are two possible ways of sending goods through rail, i.e. passenger train and goods train. The sender of goods has to evaluate the utility of passenger and goods trains and opt for one of them as means of transport. There are limited bogies for carrying goods in passenger train. Passenger trains have scheduled timings for arrival and departure, so goods sent through them reach quickly at scheduled time but freight charged by passenger trains and more than freight charges by goods train. Perishable goods have very short period market, so it is always safe and suitable to send these goods through passenger trains. Perishable goods consist of vegetable, milk, fruits, eggs, fish etc. it will be better to send non-perishable goods through goods train, because of lesser charges and no haste for delivery.

ADVANTAGES OF RAIL TRANSPORT

1. Suitable for long distance inland transport.
2. Safe means of transport for bulky goods.
3. Helpful in agricultural development.
4. Helpful in industrial development.
5. Helpful in the development of Trade and Commerce.

DISADVANTAGES OF RAIL TRANSPORT

The main disadvantages are as:

1. Railway lines do not reach the godowns of business houses so the cost of loading and unloading goods increases.
2. Rail transport is not elastic. Railway lines are fixed, so they can not move as per wishes and requirements of the business as in the case of road transports.
3. Rail accidents cause heavy losses.
4. Rail transport requires heavy capital expenditure.
5. Victim of red tapism because of being public sector enterprise.

Road Transport: Road transport is the transportation of goods through roads. It is the most popular means of land transport. Road transport has the capability to reach every corner.

ADVANTAGES OF ROAD TRANSPORT

The main merits are as:

1. **Delivery of goods from godown to godown.**
2. **Safety of goods.** There is no need for goods being loaded and unloaded many times, so it remains safe and intact.
3. **Small capital.**
4. **Time savings.**
5. **Suitable for perishable goods.**

DISADVANTAGES OF ROAD TRANSPORT

1. Slow speed
2. Seasonal hindrance.
3. Uncertainty of time.
4. More chances of accidents.
5. Unsuitable for heavy goods.

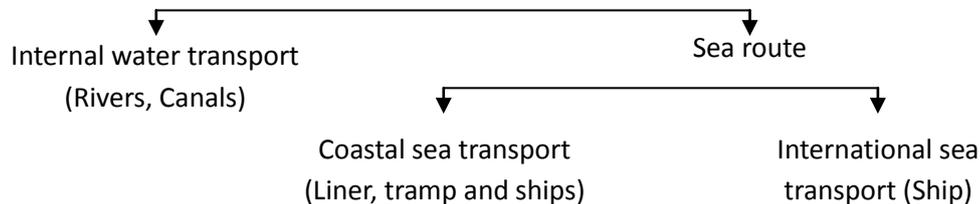
Comparison between Railways and Roadways

S. No.	Points of difference	Railways	Roadways
1	Distance	The railways are the best means of long distance travelling	The roadways are the best suited for the short distance travelling
2	Links	The railways connect the metropolitan cities with each other.	The roadways are the best means of connecting small cities, towns and villages
3	Hilly areas	In the hilly areas, it is difficult as well as expensive to construct railways lines due to the gradient of slope.	The roadways are useful for plains as well as in hilly areas, because less cost and less labour is incurred in constructing roads
4	Types of goods	The railways can easily transport heavy and spacious goods, such as minerals, iron and steel products and machines etc.	The roadways are helpful in transporting perishable products like fresh fruits, vegetables and breakable commodities like glass, China clay utensils etc.

WATER TRANSPORT

Water Transport. Water Transport is the cheapest means of transport, because it does not require huge expenditure for construction of roads and railways lines as in the case of road and rail transport. It does not use the costliest resources as in the case of air transport.

MEANS OF WATER TRANSPORT



Inland water transport. Rivers and canals are the two routes of inland water transport. Rivers are the gift of nature. We are not required to incur heavy expenditure in making river routes. Rivers are the most suitable for sending wood from dense forests and hilly areas. We use boats, steamers and motor boats for river transport.

Coastal and Oceans Shipping. Seas transport has assumed much importance. These ships are built with heavy cost, even then it is cheaper to carry goods through ships, because sea route is natural route and does not require expenditure for constructing route. Ships are classified as liners and tramps:

Liners. These ships carry cargo (goods) and passengers between two parts according to prescribed schedule. These liners are owned by big shipping companies who form shipping ring to regulate freight etc.

Tramps: These ships neither have regular journey nor scheduled timings for arrival and departure. These ships carry goods only.

ADVANTAGES OF WATER TRANSPORT

1. Cheapest means of transport
2. Growth of foreign trade
3. Suitable for heavy goods
4. Suitable for longer distance.
5. More carrying capacity.

DISADVANTAGES OF WATER TRANSPORT

1. Slow speed
2. Natural hindrance
3. Long water routes
4. More loading and unloading expenses
5. Unsuitable for perishable goods.

Air Transport: Air transport has revolutionized the field of transport. It is the most popular means of transport for carrying passengers and goods from one corner to other corner of the world. This transport is free from geographical hurdles. It is the fastest means of transport and the most suitable for carrying perishable goods but at the same time it is the costliest means of transport also. Air transport has got the following advantages and disadvantages.

ADVANTAGES OF AIR TRANSPORT

1. Fastest means of transport
2. Time saving
3. Free from geographical hurdle
4. Suitable for perishable goods
5. Helpful in the administration

DISADVANTAGES OF AIR TRANSPORT

1. More freight charges
2. Seasonal hurdles
3. Limited carrying capacity
4. Plane hijacking

PIPE LINE TRANSPORT

It has also been introduced because of its low energy consumption, low transit losses and low overall running cost. Pipelines have been constructed to transport crude oil, petroleum products and natural gases.

The Indian Oil Corporation has built an extensive network of pipelines for its product. Every refinery has its pipeline links to its nearest central places.

Gas Authority of India was set up in August, 1984, to construct and operate 730 Kms pipeline, the Hazira-Bijapur-Jagdishpur pipeline. We have also been laying pipeline for the movement of iron ore in slurry form (a mixture of fine ore and water).

Selection of Suitable Means of Transport. While selecting the suitable means of transport following factors should be taken into consideration:

1. **Distance.** It is the most important consideration. For long distance water and air transport are suitable. In case of inland trade for long distance railways should be preferable used.
2. **Availability of means of transport.** Water and air transport facilities are not available at every place, so the choice has to be made between rail and road transport. If railway station is not available at forwarding and destination place road transport will be suitable.
3. **Nature of commodity.** If the commodity to be sent is bulky and heavy, water transport in case of foreign trade and railways in case of inland trade is preferable. Perishable goods should be sent by air transport in case of foreign trade passengers train or road transport in case of inland trade.
4. **Cost of transportation.** Cost of transportation adds to the cost of production, so means of transportation should be selected taking into consideration the cost factors.
5. **Other Considerations.** Loading, unloading facilities, warehousing, packing, delivery and cold storage facilities etc. are other factors determining the means of transport. Railways have recently started container services.

Principles of Transport Management. There are two fundamental principles guiding transportation management and operations. These are: (i) economy of scale and (ii) economy of distance.

- (i) **Economy of Scale.** It refers to the characteristic that transportation cost per unit of weight decreases when the size of the shipment increases. It is also generally true that larger capacity transportation vehicles such as rail or water are less expensive per unit of weight than smaller capacity vehicles such as motor or air. Transportation economies of scale exist because fixed expenses associated with moving a load can be spread over the load's weight.
- (ii) **Economy of Distance.** It refers to the characteristic that transportation cost per unit of distance decreases as distance increases. For example, a shipment of 800 miles will cost less than two shipments (of the same combined weight) of 400 miles. Transportation economy of distance is also referred to as the tapering principle since rates or charges taper with distance. These principles are important consideration when evaluating alternative transportation strategies or operating practices. The objective is to maximize the size of the load and the distance that it is shipped while still meeting customer service expectations.

TOPIC: PACKAGING

Introduction to packaging

Packaging has a significant impact on the cost and productivity of the logistical system. The purchase of packaging materials, the institution of automated or manual packaging operations, and the subsequent need of material disposal are the most obvious costs. What is not readily apparent, however, is that purchase and disposal costs are borne by firms at opposite ends of a distribution channel, and that productivity gains generated by efficient packaging are spread throughout a logistical system. As a result, the impact of packaging is easily overlooked or, at minimum, underestimated. **Packaging can generally be categorized into two types – consumer packaging, which has a marketing emphasis, and industrial packaging, which has more of a logistics emphasis.**

Consumer Packaging (Marketing Emphasis)

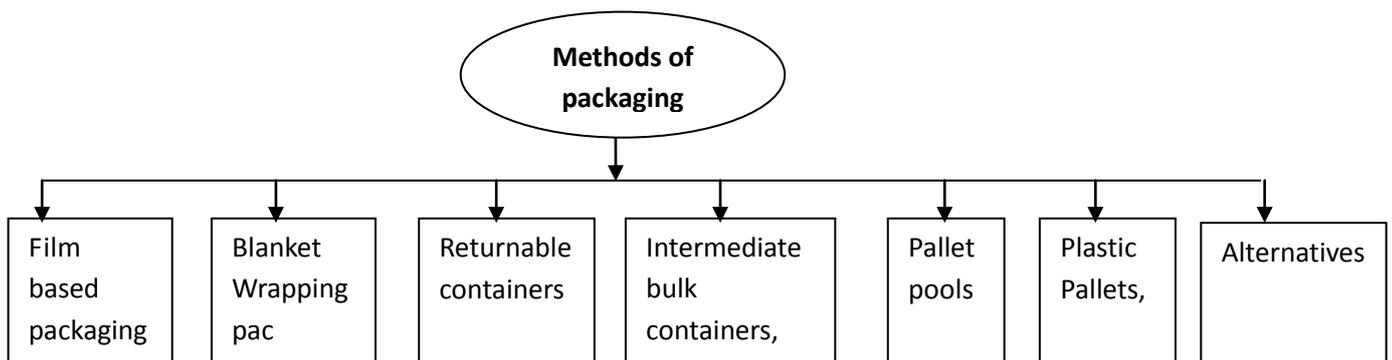
1. Package design is most often based on manufacturing and marketing considerations at the neglect of logistical requirements. For example, shipping such product as fully assembled motorcycles results in a substantial reduction in destiny. A low-destiny package means higher transportation rates and greater warehouse storage requirements.
2. Consumer packaging design focuses on customer convenience, market appeal, retail shelf utilization, and product protection. In general, ideal consumer packaging (e.g., large containers and odd sizes that increase consumer visibility) makes very poor logistical packaging.

Industrial Packaging (Logistics Emphasis)

1. Individual products or parts are normally grouped into cartons, bags, bins or barrels for handling efficiency. These containers are used to group individual products and are referred to as master cartons. When master cartons are grouped into larger units for handling, the combination is referred to as containerization or utilization.
2. The master carton and the unitized load provide the basic handling unit in the logistics channel.

Various methods of packaging

The loosening of traditional cardboard standards, competitive, industry conditions encouraging an integrated system approach and technological innovation have triggered a renaissance in logistical packaging. The following are the recent trends in logistical packaging methods – (i) Film-based packaging (ii) Blanket Wrapping, (iii) Returnable containers (iv) Intermediate bulk containers, (v) Pallet pools, (vi) Plastic Pallets, and (vii) Alternatives that require special material-handling equipment.



1. Film-based packaging

- a. Film based packaging utilizes flexible materials rather than rigid packaging such as corrugated fiberboard boxes.
- b. In today’s emerging applications, they are used to form actual shipping “packages” for consumer goods such as cans and bottles, furniture, appliances and small vehicles.
- c. Flexible packaging offers several advantages over traditional rigid packaging method. Film-based systems operate automatically, reducing labour costs of manually boxing products. Packaging standardization is achieve since a roll of film fits most product configurations equally well and thus eliminates the need to maintain inventories of various sized boxes.

- d. Film-based system provide reductions in inventory storage space because a roll of film is similar than pallets of empty or flattened boxes.
- 2. Blanket Wrapping**
- Blanket wrapping is a traditional form of packaging provided by “moving van” carriers of households’ goods. Packaging of this nature is ideally suited for ‘nesting’ irregular-shaped products like chairs that otherwise would have to be individually packed in corrugated fiberboard boxes.
 - The blanket-wrap concept has been extended into premium commercial “uncartoned” transportation service offered by divisions of many household goods carriers.
 - Uncartoned transportation service is best suited for truckload quantities of large rugged product like sofas, office furniture, laboratory equipment, restaurant furnishings, or store fixtures. Advantages include elimination of package material and waste, minimization of transportation cube, and easier unpacking of products.
- 3. Returnable containers**
- Returnable containers have always been a part of logistical systems. Most reusable packages are steel or plastic, although some firms reuse corrugated fiberboard boxes.
 - Automobile manufacturers use returnable racks for interplant shipment of body parts, and chemical companies reuse steel drums. There is an increasing trend, however, towards reusable packaging applications for many small items and parts, such as ingredients, and for interplant shipments as well as retail warehouse-to-store totes.
 - In a returnable package system, the parties must explicitly cooperate in order to maximize container usage; otherwise containers may be lost, misplaced, or forgotten.
- 4. Intermediate Bulk Containers** – (IBCs) are used for granular and liquid product shipment quantities that are smaller than tank cars but larger than bags of drums. Typical products include resin pellets, food ingredients, and adhesives. The most frequently used intermediate bulk containers are bulk bags and boxes.
- 5. Pallet Pools**
- Pallet Pools have been developed to overcome traditional problems with the disposal and exchange of pallets.
 - Pallet pools are third-party suppliers that maintain and lease high-quality pallets throughout the country. They offer reduced damage, lower disposal costs and improved utilization of pallet resources. Pallet pools are common in Europe and are making substantial inroads in the North American grocery industry.
- 6. Plastic Pallets** – Plastic pallets have been an issue of research and examination for many years, particularly within the grocery industry. They attempt to address the shortcomings of wooden pallets and are sanitary, lightweight, and recyclable. Their life-cycle costs are comparable to traditional wooden pallets. However, they do require greater initial investment, and because of that expense, the only way they can be utilized on an industry wide basis is through tightly controlled networks of management.
- 7. Refrigerated Pallets** – The refrigerated pallet illustrates a technology that integrated the environmental and unitization demands of specialty products. It is a self-contained refrigerated shipping unit (comparable in size to a loaded shipping pallet) that can be placed inside a regular dry van as an LTL shipment. It eliminates dependency on refrigerated trucks and makes just-in-time delivery of perishable products possible.

UNIT-IV INVENTORY PLANNING

Demand Forecasting

Demand forecasts form the basis of all supply chain planning. All the push processes in the supply chain are performed in anticipation of customer demand, whereas all pull processes are performed in response to customer demand.

For push processes to customer must plan the level of activity; production, transportation or any other

planned activity. For pull processes, a manager must plan the level of available capacity and inventory but not the actual amount to be executed. In both the instances, the first step a manager must take is to forecast what customer demand will be.

For example: Dell orders PC components in anticipation of customer orders, whereas it performs assembly in response to customer orders. Dell uses a forecast of future demand to determine the quantity of components to have on hand (a push process) and to determine the capacity needed in its plants (for pull production). When all stages of a supply chain work together to produce a collaborative forecast, it tends to be much more accurate. The resulting forecast accuracy enables supply chains to be both more responsive and more efficient in serving their customers.

Characteristics of Forecasts

1. Forecasts are always wrong and thus should include both the expected value of the forecast and a measure of forecast error.
2. Long-term forecasts are usually less accurate than short-term forecasts; i.e. long-term forecasts have a larger standard deviation of error relative to the mean than short-term forecasts.
3. Aggregate forecasts are usually more accurate than disaggregate forecasts, as they tend to have a smaller standard deviation of error relative to the mean.

Impact of Forecasts on SCM

Demand forecasting is the base for supply chain planning. It is essential for making supply chain decisions. A supply chain manager follows push/pull strategies. All push processes in the supply chain are performed in anticipation of customer demand whereas all pull processes are performed in response to customer demand.

The various areas of supply chain management which are largely affected by forecasts are:

1. **Manufacturing Facilities:** Clearly, the trends in demand for specific products and locations will have a significant impact on the appropriate facility strategies. The location of manufacturing facilities, as well as the choices of technologies, products and markets served should all take into account the forecast for demand.
2. **Distribution Facilities:** Decisions concerning distribution facilities are also affected by long-range forecasts. The size of the warehouse, the type of technology and the locations, all depend on the forecasts. Strategically, both logistics and manufacturing facilities need to be considered together.
3. **Transportation Equipment and Contracts:** Forecasts of long-term demand and the breakdown of demand into product groups and geographic regions will have a significant impact on transportation equipment and contracts.
4. **Supply Contracts and Purchasing:** Purchasing ranges from short term needs over the next week or month to long-term supply contracts for critical raw materials. Short-term supply needs and long-term vendor relations are critically dependent on forecasts.
5. **Production Planning and Inventory Control:** Production planning and inventory control require accurate forecasts at the detailed level, incorporating both averages and predicted deviations. The design of the manufacturing and logistics systems requires a certain level of flexibility and depends on the quality of the forecasting system.

FORECASTING TECHNIQUES

These can be classified as:

- i) Qualitative Techniques
- ii) Quantitative Techniques

i) Qualitative techniques –

Qualitative forecasting techniques are generally more subjective than their quantitative counter-parts. Qualitative techniques are more useful when less past data exists for use in quantitative methods. These techniques include Delphi technique, Nominal Group Technique (NGT), Sales Force Opinions, Executive opinions and Market Research.

1. **The Delphi Techniques:** The Delphi technique uses a panel of experts to produce a forecast. Each expert is asked to provide a forecast keeping in view the situation.
2. **Nominal Group Techniques:** Nominal Group Techniques is similar to the Delphi technique in that it utilizes a group of participants, usually experts. After the participants respond to forecast-related questions, they rank their responses in order of perceived relative importance. Then the ranking are collected and aggregated.
3. **Sales Force Opinions:** The sales staff is often a good source of information regarding future demand. The sales manager may ask for input from each sales-person and aggregate their responses into a sales force composite forecast.
4. **Executive Opinions:** Sometimes upper levels managers meet and develop forecasts based on their knowledge of their areas of responsibility. This is sometimes referred to as jury of executive opinion.
5. **Market Research:** In market research, consumer surveys are used to establish potential demand. Such marketing research usually involves constructing questionnaire that solicits personal, demographic, economic and marketing information. On occasion, market researchers collect such information in person at retail outlets and malls, where the consumer can experience taste, feel, smell and see-a particular product.

Quantitative Techniques

Quantitative forecasting techniques are generally more objective than their qualitative counterparts. Quantitative forecasts can be time-series forecasts. Time-series data may have underlying behaviors that need to be identified by the forecaster. Among the patterns are:

- Trends, which are long-term movements (up or down) in the data.
 - Seasonality, which produces short-term variations that are usually related to the time of year, month or even a particular day, as witnessed by retail sales at Christmas or the spikes in banking activity on the first of the month and on Fridays.
 - Cycles, which are wavelike variations lasting more than a year that are usually tied to economic or political conditions.
 - Irregular variations that do not reflect typical behavior, such as a period of extreme weather or a union strike.
 - Random Variations, which encompass all non-typical behaviors not accounted for by the other classifications.
1. **Naive Forecasting:** Among the time-series models, the simplest is the Naïve Forecast. A naive forecast simply uses the actual demand for the past period as the forecasted demand for the next period. This, of course makes the assumption that the past will repeat. An example of naïve forecasting is presented in Table 1.

Period	Actual Demand (000's)	Forecast (000's)
January	45	
February	60	45
March	72	60
April	58	72
May	40	58
June		40

Table 1

2. **Moving Average Forecast:** Another simple technique is the use of averaging. To make a forecast using averaging, one simply takes the average of some number of periods of past data by summing each period and dividing the result by the number of periods. This technique has been found to be very effective for short-range forecasting. Assuming a three-month moving average and using the data from Table 1, one would simply add 45

(January), 60 (February) and 72 (March) and divide by three to arrive at a forecast for April

$$45 + 60 + 72 = 177 / 3 = 59$$

To arrive at a forecast for May, one would drop January's demand from the equation and add the demand from April. Table 2 presents an example of a three-month moving average forecast.

Period	Actual Demand (000's)	Forecast (000's)
January	45	
February	60	
March	72	
April	58	59
May	40	63
June		57

Table 2

- Weighted Moving Average Forecast:** A weighted average applies a predetermined weight to each month of past data, sums the past data from each period and divides by the total of the weights. If the forecaster adjusts the weights so that their sum is equal to 1, then the weights are multiplied by the actual demand of each applicable period.
- Exponential Smoothing:** A more complex form of weighted moving average is exponential smoothing, so named because the weight falls off exponentially as the data ages. Exponential smoothing takes the previous period's forecast and adjusts it by a predetermined smoothing constant, α (called alpha; the value for alpha is less than one) multiplied by the difference in the previous forecast and the demand that actually occurred during the previously forecasted period (Called forecast errors). Exponential smoothing is expressed formulaically as such:
New Forecast = previous forecast + alpha (actual demand - previous forecast)

INVENTORY PLANNING

Planning consists of determining when and how much to order. Time is determined by average and variation in demand and replenishment. While quantity is determined by the order quantity.

- When to order:** The reorder point defines when a replenishment shipment should be initiated. It can be specified in terms of units or days supply.
 $R = D \times T$
 Where -
 R = Reorder points in units.
 D = Average daily demand in units.
 T = Average performance cycle length in days.
- How much to order:** Average inventory is equal to one-half of the order quantity. Hence greater order quantity will lead to larger average inventory which increases annual carrying cost.

EOQ Model

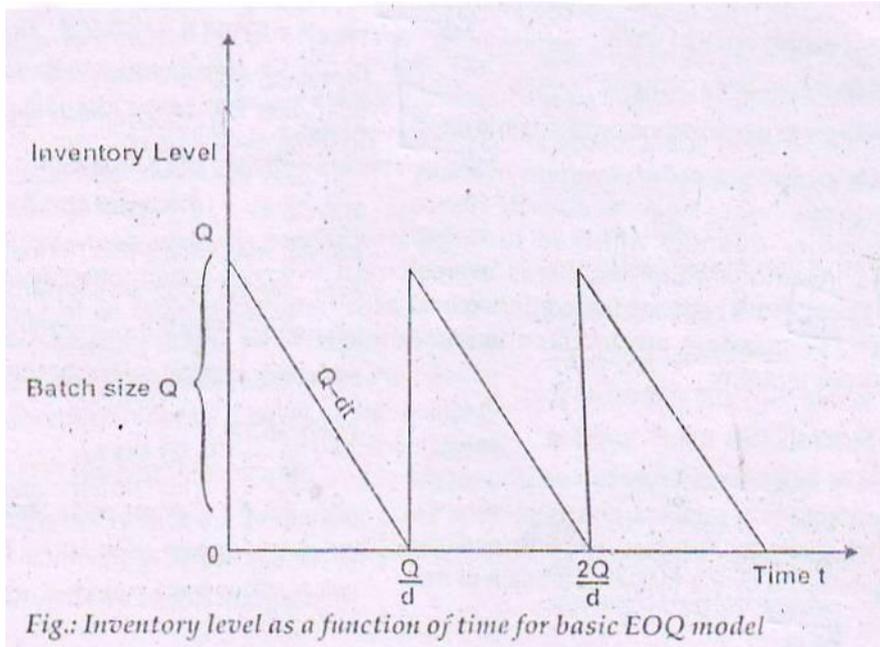
The most common inventory situation faced by manufacturers, retailers and wholesalers is that stock levels are depleted over time and then are replenished by the arrival of a batch of new units. A simple model representing this situation is the following Economic Order Quantity model or, for short, the EOQ model. (It sometimes is also referred to as the economic lot-size model)

For the basic EOQ model to be presented first, the only costs to be considered are:

K = Setup cost for ordering one batch.

c = Unit cost for producing or purchasing each unit.

h = Holding cost per unit per unit of time held in inventory. The objective is to determine when and by how much to replenish inventory so as to minimize the sum of these costs per unit time.



Assumptions (Basic EOQ Model)

1. A known constant demand rate of d units per unit time.
2. The order quantity (Q) to replenish inventory arrives all at once just when desired, namely, when the inventory level drops to 0.
3. Planned shortages are not allowed.

Reorder point = (demand rate) \times (lead time)

PLANNING OF STOCKING FACILITIES

Stocking

Inventory is a stock of goods (or material) required by an organization for its successful operations. To a material controller, inventory refers to the material he is asked to purchase and keep safe in storehouse, so that they remain serviceable till used. But to a finance controller, inventory refers to the value of material carried in the storehouse in which the funds of the organization remains invested.

Reasons behind Holding Inventory

- i) The very first reason behind holding the 'idle resource' i.e., inventory is requirement. Requirement for the future period. An arrangement made today for future helps in smooth functioning of any activity.
- ii) Everyone can make assumption on the basis of past trends but nobody can predict future, in the same way raw material availability in the past was very good, but we cannot predict what it will be going tomorrow. Therefore in order to safeguard from such contingencies (unforeseen) happenings, a provision for tomorrow is made today.
- iii) The reason behind smooth functioning of the organization is inventory, although at few juncture the market forces may not allow for that, the fluctuation in market condition where supply and demand curve is following a zigzag line holding of inventory assures continuous and uninterrupted industries operation.
- iv) Seasonality of the market and material also affects to a great extent. Suppose a raw material required is a seasonal crop, which grows just one a year, has to be procured during these year. Lets take an example of soya oil plant/refinery. For a smooth functioning of this plant, it requires Soya seeds at main material.
 This is available in market just one a year. So the material controller has to procure it for the entire year irrespective of the price. Therefore, the idle resource has to be held in advance.
- v) A material manager has to keep a birds eye on the price trend in the market. He should have a sharp knowledge as to the price movements. Whenever he thinks that the prices effective in the market are at its lowest, he must procure it.

Planning of Stocking Facilities

The objectives of a firm in managing inventories should be to achieve the wealth maximization principle. For this purpose, the optimum level of inventory should be determined. To manage inventory, following two questions are very important:

- a) How much should be ordered?
- b) When should it be ordered?

The first question how much should be ordered relates the problem of determining economic order quantity (EOQ).

Economic order quantity (EOQ)

One of the major inventory management problems is to determine how much inventory should be added when the inventory is to be ordered. If a firm is planning for production, it is important to determine how much production should be done. If the firm is buying raw materials, it is to be decided how much it should be purchased.

When we are required to determine the optimum inventory level, it involves two types of costs:

- i) Ordering costs and
- ii) Carrying costs.

The Economic Order Quantity (EOQ) is that inventory level which minimize the total of ordering and carrying costs.

- i) **Ordering Costs:** The term ordering costs is used in case of raw material and includes cost of acquiring raw materials. They include purchase ordering, transporting, receiving, inspecting and storing. Normally the cost of clerical staff is not considered because it is not affected by the order of goods but it is argued that if the number of orders increases, the clerical and staff cost will also increase. Ordering cost vary with the number of orders. If the orders are placed frequently or again and again, the firm’s ordering cost will be higher. On the other hand if firm maintains large inventory level, the number of orders will be few and so the ordering cost will be relatively small.
- ii) **Carrying Costs:** The expenses which are incurred to maintain a given level of inventory are called carrying costs. It includes storage, insurance, taxes, obsolescence, etc. The storage includes warehousing, handling and administrative costs.

Ordering and Carrying Costs

Ordering Costs	Carrying Costs
Requisitioning	Warehousing
Order placing	Handling
Transportation	Clerical and staff
Receiving, inspection and storing	Insurance
Clerical and staff	Deterioration and obsolescence

Carrying cost vary with the size of inventory, type of material, type of storage facilities available and other factors.

MANAGEMENT OF WAREHOUSE

BENEFITS OF A WAREHOUSE

Economic Benefit – Economic benefits of warehousing result when overall, logistical costs are directly reduced by utilizing one or more facilities. It is not difficult to quantify the return on investment of an economic benefit because it is reflected in a direct cost-to-cost trade-off. For example, if adding a warehouse to a logical system will reduce overall transportation cost by an amount greater than the fixed and variable cost of the warehouse, then total cost will be reduced. Whenever total-cost reductions are attainable, the warehouse is economically justified. **Four basic economic benefits are consolidation, break bulk-and cross dock, processing/ postponement, and stockpiling. Each is discussed and illustrated.**

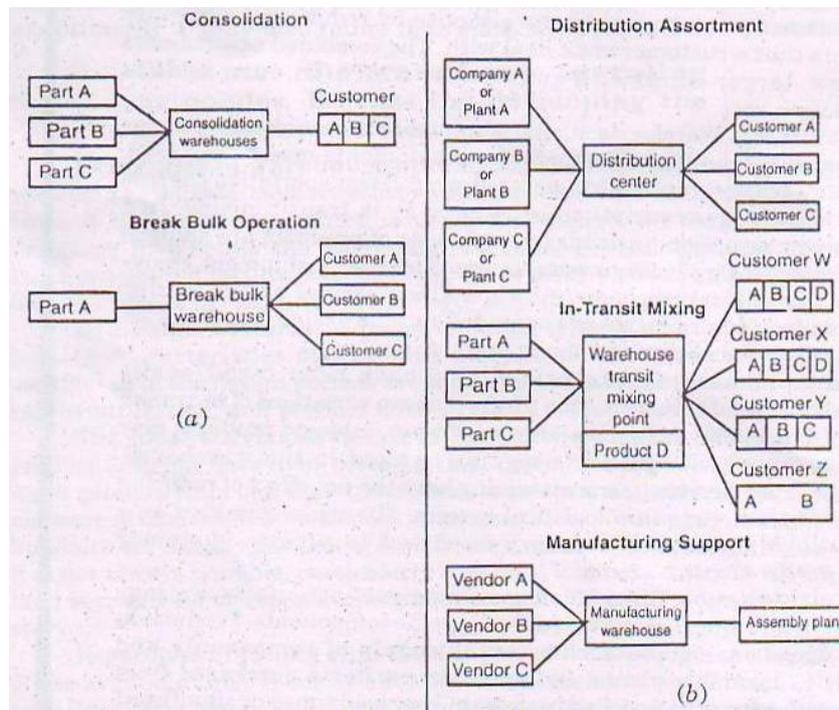


Figure: Warehouse Benefits

- 1) **Consolidation** – Shipment consolidation is an economic benefit of warehousing. With this arrangement, the consolidating warehouse receives and consolidates materials from a number of manufacturing plants destined to a specific customer on a single transportation shipment. The benefits are the realization of the lowest possible transportation rate and reduced congestion at a customer’s receiving dock. The warehouse allows both the in bond movement from the manufacturer to the warehouse and the out bond movement from the warehouse to the customer to be consolidated into larger shipments. Figure 1 (a) illustrates the warehouse consolidation flow.

In order to provide effective consolidation, each manufacturing plant must use the warehouse as a forward stock location or as a sorting and assembly facility. The primary benefit of consolidation is that it combines the logistical flow of several small shipments to a specific market area. Consolidation warehousing may be used by a single firm, or a number of firms may join together and use a for-hire consolidation service. Through the use of such a program, each individual manufacturer or shipper can enjoy lower total distribution cost than could be realized on a direct shipment basis individually.

- 2) **Bulk and Cross Break Dock** – Break bulk and cross-dock warehouse operations are similar to consolidation except that no storage is performed. A break bulk operation receives combined customer orders from manufacturers and ships them to individual customers. Figure 1 (a) illustrates the break bulk flow. The break bulk warehouse or terminal sorts or splits individual orders and arranges for local delivery. Because the long-distance transportation movement is a large shipment, transport costs are lower and there is less difficulty in tracking.

A cross-dock facility is similar except that it involves multiple manufacturers. Retail chains make extensive use of cross-dock operations to replenish fast-moving store inventories. Figure 1b illustrates a retail cross-dock application. In this case, full trailer loads of product arrive from multiple manufacturers. As the product is received, it is either sorted by customer if it is labeled or allocated to customers if it has not been labeled. Product is then literally moved “across the dock” to be loaded into the trailer destined for the appropriate customer. The trailer mixed product from multiple manufacturers. The economic benefits of cross docking include full trailer movements from manufacturers to the warehouse and from the warehouse to retailers, reduced handling cost at the cross-dock facility since product is not stored, and more effective use of clock facilities because all vehicles are fully loaded, thus maximizing loading clock utilization.

- 3) **Processing/ Postponement** – Warehouses can also be used to postpone, or delay, production by performing processing and light manufacturing activities. A warehouse with packaging or labeling capability allows postponement of final production until actual demand is known. For example, vegetables can be processed and canned in “bright” at the manufacturer. Bright are cans with no preattached labels. The use of bright for a private label product means that the item does not have to be committed to a specific customer or package configuration at the manufacturer’s plant. Once a specific customer order is received, the warehouse can complete final processing by adding the label and finalizing the packaging. Processing and postponement provide two economic benefits. First, risk is minimized because final packaging is not completed until an order for a specific label and package has been received. Second, the required level of total inventory can be reduced by using the basic product (bright) for a variety of labeling and packaging configurations. The combination of lower risk and inventory level often reduced total system cost even if the cost of packaging at the warehouse is more expensive than it would be at the manufacturer’s facility.
- 4) **Stockpiling** – The direct economic benefit of this warehousing service is secondary to the fact that seasonal storage is essential to select businesses. For example, lawn furniture and toys are produced year-round and primarily sold during a very short marketing period. In contrast, agricultural products are harvested at specific times with subsequent consumption occurring throughout the year. Both situations require warehouse stockpiling to support marketing efforts. Stockpiling provides an inventory buffer, which allows production efficiencies within the constraints imposed by material sources and the customer.

Service Benefits – Service benefits gained through warehouses in a logistical system may or not reduce costs. When a warehouse is primarily justified on the basis of service, the supporting rationale is an improvement in the time and place capability of the overall logistical system. It is often difficult to quantify the return on investment of such a rationale because it involves cost-to-service a specific market segment may increase cost but might also increase market share, revenue, and gross margin. At a conceptual level, a service-justified warehouse would be added if the net effect was profit-justified. At an operational level, the problem is how to measure the direct revenue impact.

Five basic service benefits are achieved through warehousing:

- | | |
|---------------|-------------------------|
| 1. Spot stock | 4. Product support, and |
| 2. Assortment | 5. Market pressure. |
| 3. Mixing | |

Each is discussed and illustrated.

1. **Spot stock** – Stock spotting is most often used in physical distribution. In particular, manufacturers with limited or highly seasonal product lines are partial to this service. Rather than placing inventories in warehouse facilities on a year-round basis or shipping directly from manufacturing plants, delivery time can be substantially reduced by advanced inventory commitment to strategic markets. Under this concept, a selected amount of a firm’s product line is placed or “spot stocked” in a warehouse to fill customer orders during a critical marketing period. Utilizing warehouse facilities for stock spotting allows inventories to be placed in a variety of markets adjacent to key customers just prior to a maximum period of seasonal sales. Suppliers of agricultural products to farmers often use spot stocking to position their products closer to a service-sensitive market during the growing season. Following the sales season, the remaining inventory is withdrawn to a central warehouse.

2. **Assortment** – An assortment warehousing – which may be utilized by a manufacturer, wholesaler, or retailer – stocks product combinations in anticipation of customer orders. The assortments may represent multiple products from different manufacturers or special assortments as specified by customers. In the first case, for example, an athletic wholesaler would stock products from a number of clothing suppliers so that customer can be offered assortments. In the second case, the wholesaler would create a specific team uniform including shirt, pants, and shoes.

The differential between stock spotting and complete line assortment is the degree and duration of

warehouse utilization. A firm following a stock sporting strategy would typically warehouse a narrow product assortment and place stocks in a large number of small warehouses dedicated to specific markets for a limited time period. The distribution assortment warehouse usually has a broad product line, is limited to a few strategic locations, and its functional year-round.

Assortment warehouse improves service by reducing the number of suppliers that a customer must deal with. The combined assortments also allow larger shipment quantities, which in turn reduce transportation cost.

3. **Mixing** – Warehouse mixing is similar to the break bulk process except that several different manufacturer shipments may be involve. When plants are geographically separated, overall transportation charges and warehouse requirements can be reduced by in-transit mixing. In a typical mixing situation, carloads or truckloads of products are shipped from manufacturing plants to warehouses. Each large shipment enjoys the lowest possible transportation rate. Upon arrival at the missing warehouse, factory shipments are unloaded and the desired combination of each product for each customer or market is selected. The economies of in-transit mixing have been traditionally supported by special transportation tariffs that are variations if in-transit privileges. Under the mixing warehouse concept, inbound products may also be combines with products regularly stored in the warehouse. Warehouses that provide in-transit mixing have the net effect of reducing overall product storage in logistical system. Mixing is classified as a service benefit because inventory or sorted to precise customer specifications.

4. **Production support** – The economics of manufacturing may justify relatively long production runs of specific components. Production support warehousing provides a steady stocks on items purchased from outside vendors may be justified because of long lead items or significant variations economical total-cost solution may be the operation of a production support warehouse to supply of “feed” processed materials, components and subassemblies into the assembly plant in an economic and timely manner.

5. **Market Presence** – While a market presence benefit may not be as obvious as other service benefits, it is often cited by marketing factor is based on the perception or belief that local warehouses (and presumably local inventory) can be more responsive to customer needs and offer quicker delivery than more distant warehouses. As a result, it is also thought that a local warehouse will enhance market share and potentially increase profitability. While the market presence factor is a frequently discussed strategy, little solid research exists to confirm its actual benefit impact.

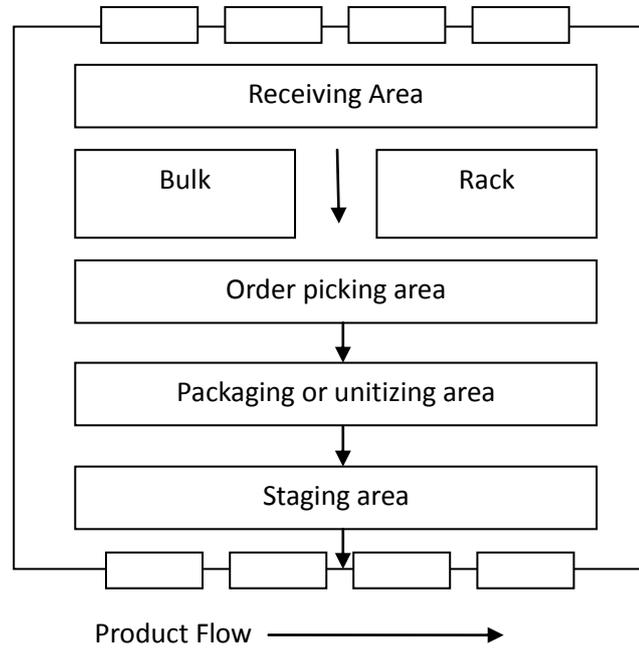
WAREHOUSE OPERATING PRINCIPLES

i) **Design Criteria** – Warehouse design criteria address physical facility characteristics and product movement. Three factors to be considered in the design process are the number of stories in the facility, height utilization, and product flow. The ideal warehouse design is limited to a single story so that product does not have to be moved up and down. The use of elevators to move product from one floor to the next requires time and energy.

Warehouse design should also allow for straight product flow through the facility whether items are stores or not. In general, this means that product should be received at one end of the building, stored in the middle, and then shipped from the other end.

ii) **Handling Technology** – The second principle focuses on the effectiveness and efficiency of material-handling technology. The elements of this principle concern movement continuity and movement scale economies. Movement continuity means that it is better for a material handler or piece of handling equipment to make a longer move than to have a number of handlers make numerous, individual, sort segments of the same move.

iii) **Storage Plan** – According to the third principle, a warehouse design should consider product characteristics, particularly those pertaining to volume, weight, and storage. Product volume is the major concern when defining a warehouse storage plan. High-volume sales or throughput product should be stored in a location that minimizes the distance it is moved, such as near primary aisles and in low storage racks. Such a location minimizes travel distance and the need for extended lifting. Conversely, low-volume product can be assigned locations that are distant from primary aisles or higher up in storage racks. Similarly, the plan should include a specific strategy for products dependent on weight and storage characteristics. Relatively heavy items should be assigned to locations low to the ground to minimize the effort sand risk of heavy lifting. Bulky or low-density products require extensive storage volume, so open floor space or high-level racks can be used for them.



Product Flow

Typical Warehouse Design

UNIT-V

Distribution: definition

Distribution is the process of getting the right products to the right places, at the right time, in the right size or quantities and in the condition expected by the consumer, yet at the lowest possible cost. Placing the product is the bridging of the gap between the producer and consumer, a gap that can be vast, such as with petroleum that is shipped across oceans.

Distribution Channel: definition

The process of making goods available to the consumer needs effective channel of distribution. Therefore, the path taken by the goods in its movement is termed as channel of distribution.

Cundiff E.W. and Still R.S. define a distribution channel as "a path traced in the direct or indirect transfer of title to a product, as it move from a producer to ultimate consumes or industrial users"

A distribution channel is "a set of interdependent organizations involved in the process of making a product or service available for use ro consumption by the consumer of business user."

A channel of distribution for a product is the mute taken by the goods as they move from the organization to the ultimate consumer or user.

According to American Marketing Association, "A channel of distribution, is the structure of intra-company organization units and extra-company agents and dealers wholesale and retail, through which a commodity, product or service is marketed

DISTRIBUTION CHANNEL FUNCTIONS

The primary purpose of a distributive channel is to bridge the gap between produce's and users by removing differences between supply and demand. For this certain essential functions need to be performed. They are:

- 1) **Information:** gathering and distributing marketing research and intelligence information about actors and forces in the marketing environment needed for planning and aiding exchange.
- 2) **Promotion:** developing and spreading persuasive communications about an offer.
- 3) **Contact:** Finding and communicating with prospective buyers.
- 4) **Matching:** Shaping and fitting the offer to the buyer's needs, including such activities as manufacturing, wading, assembling and packaging,
- 5) **Negotiation:** Reaching an agreement on price and other terms of the offer so that ownership or possession can be transferred.
- 6) **Physical distribution:** Transporting and storing goods.
- 7) **Financing:** Acquiring and using funds to cover the costs of the channel work
- 8) **Risk taking:** Assuming tile risks of carrying out the channel work

Factors affecting Choice of a channel of distribution

The factors to be considered before choosing a suitable channel of distribution are listed below:

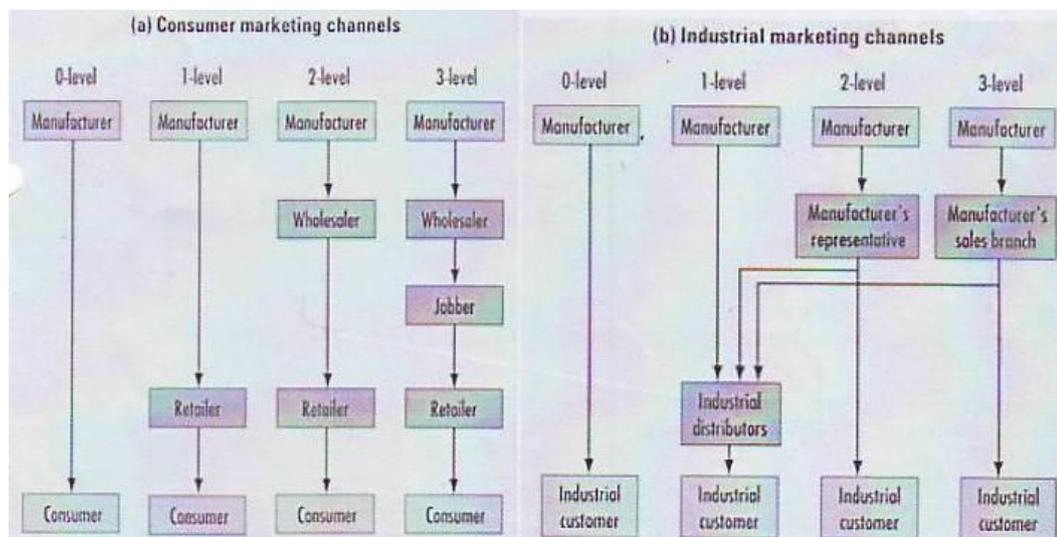
- 1) **Product considerations:** The nature and type of product have an important bearing on the choice of distribution channels. For examples, perishable goods need speedy movements and hence shorter channel or route of distribution; for durable goods, longer and diversified channels may be used; similarly, for technical products requiring specialized selling and serving talents, the shortest channel should be used.
- 2) **Market considerations:** The nature and type of customers and size of market are important considerations in the choice of a channel of distribution. For example, if the market size is large, there may be long channels, whereas in a small market direct selling may be profitable. The nature and type of consumers include factors such as desire for credit, preference for the stop shopping, demand for personal services, amount of time and effort the customer is willing to spend. It also includes factors like age, income group, sex, and religion of customers.

- 3) **Company considerations:** The nature, size and objectives of the business firm also play an important role in the selection of distribution channel. It includes financial resources, market Standing, volume of production, desire for control of channel, services provided by manufacturers', etc. For example a company with substantial financial resources need not rely too much on the middlemen and can afford to reduce the levels of distribution. Similarly a company desiring to exercise greater control over channel will prefer a shorter channel.
- 4) **Middlemen considerations:** The cost and efficiency of distribution depend largely on the nature and type of middlemen. It includes characteristics of middlemen such as availability, attitudes, services, sales potential, costs etc. For example, if the terms and conditions of engaging wholesalers are unfavorable a manufacturer may like to channelize his products through semi wholesalers or retailers, thereby, bypassing wholesalers. However, the determining factor would be the differential advantage involved in the choice.

Distribution Channel levels

Channel levels consist of consumer marketing channels or the industrial marketing channels. A factor common among both channel levels is that both include the producer as well as the end customer.

- 1) **Zero Level channel / Direct Marketing Channel** — Consists of a manufacturer directly selling to the end consumer. This might mean door to door sales, direct mails or telemarketing. Dell online sales is a perfect example of a zero level channel marketing.
- 2) **One Level channel** — As the name suggests, the one level channel has an intermediary in between the producer and the consumer. An example of this can be insurance in which there is an insurance agent between the insurance company and the customer.
- 3) **Two level Channel** — A widely used marketing channel especially in the FMCG and the consumer durables industry which consists of a wholesaler and a retailer.
- 4) **Three level channel** — Again observed in both the FMCG and the consumer durables industry, the three level channel can combine the roles of a distributor on top of a dealer and a retailer. The distributor stocks the most and spreads it to dealers who in turn give it to retailers.



CUSTOMER SERVICE STRATEGY

Definition of customer service strategy

"Customer service strategy refers to a process of cost-efficient, value-added benefits provided to exploit the marketing capability in making actual sales as well as retaining their happiness loyalty and motivation towards firm's offering."

Components of Customer Service strategy

I. Availability

Availability is the capacity to have inventory when desired by a customer. It is generally found that an organization invest sufficient time, money and efforts to generate customer demand and then fail to have product available to meet customer requirements. Availability is based on three performance measures —

- 1) **Lock out frequency** — A stock out occurs when a firm has product to fulfill customer demand. Stock out frequency refers to the probability that a firm will have no inventory available to meet a customer order. The aggregate of all stock outs in all products indicates how well a firm is managed to provide basic service commitment in product availability.
- 2) **Fill Rate** — Fill rate measures the magnitude of stock outs. It is important to determine how many units the customer wanted when the product is not available. For example, if a customer wants 100 units of an item and only 95 are available, the fill rate is 95%. Fill rate can be used to differentiate the level of service to be offered on specific products. If some of the items are not critical, the fill rate of 95% may be acceptable. On the other hand, if all hundred products ordered were critical to the customer the fill rate of 95% could result in a stock out and may disturb the operations.
- 3) **Fulfillment of customer's order** — The most important measures of performance in product availability is fulfillment of customer's order. It observes everything that a customer order has been fulfilled at the standard of acceptable performance. Failure to provide even one item on a customer's order is recorded as zero in terms of complete shipment.

II. Operational Performance

Operational performance is concerned with the time required to deliver a customer's order. Operational performance is specified in terms of speed consistency flexibility and malfunction recovery.

- 1) **Speed** — Speed in operational performance refers to the time from when a customer puts an order until the product is delivered and is ready for customer use. It is natural that most of the customers want fast order cycle performance. Speed is an essential part in many just-in-time and quick response logistical strategies. However, all customers may not need maximum speed because speed of service increases total cost.
- 2) **Consistency** — Consistency in operational performance is measured by the number of times that actual cycles meet the time planned for completion. Through the speed of service is important but most of the logistical managers place greater value on consistency because it directly affects the ability of a customer to plan and perform its own activities. Consistency is fundamental for effective logistic operations because it is very common for customers to specify a desired date and even a delivery appointment when placing orders. In fact, customers frequently place orders far in advance of their need. In such situations, it is very difficult for customers to understand why failure occurs.
- 3) **Flexibility** — Flexibility refers a firm's ability to accommodate unexpected customer requests, for example, the standard pattern for servicing a customer may be to ship quantities in a complete lot to the warehouse of customer. However, the customer may desire from time to time, to have shipments of smaller quantities direct to individual retail locations. The logistical competency of a firm is judged by how well it will be able to accommodate such unexpected circumstances.
- 4) **Malfunctions Recovery** — Even if the firm's logistical operations are well managed malfunction will occur. The continuous performance of service commitments on a day-to-day basis is a difficult task. Adjustment can be made to prevent special situations. For example, if a stock out of an essential item occurs at a warehouse, the item may be obtained from an alternative facility by utilizing some faster mode of transportation. Such situations would be transparent to the customer.

III. Service Reliability

Service reliability involves ability of a firm to perform all activities relating to order as well as provide information regarding logistical operations to the customers. Reliability may mean that shipment arrive damage free, invoices are correct and error free, shipments are made to the correct locations and the exact quantity of product ordered is included in the shipment. Apart from this service reliability involves capability and willingness to provide accurate information to customers regarding operations and order status.

IDENTIFICATION OF SERVICE NEEDS OF CUSTOMERS

Introduction: Identification of service needs of customers is important not only in winning new customers but also for keeping the existing customers. Now days, the focus of marketing is on the creation of relationships' with customers. The idea is that we should try to create such a level of satisfaction with

customers that they do not feel it necessary even to consider alternative offers or suppliers.

The process of identification customer's service needs may be divided into following three stages —

- 1) **Identification of key-components of Customer Services** — It is essential to develop an understanding of the service needs of customers through detailed research. The first step is to identify factors which influence the purchase decision of customer. Once the decision-making unit in a specific market has been identified, a small research programme should be initiated. It should be based upon personal interviews with a representative sample of buyers. The purpose of these interviews is to identify the elements important from customer's services point of view such as price, product quality, promotion, etc.
- 2) **Establish the Relative Importance of Customer Service Components** — In order to discover the relative importance of the service components, one simple way is to ask a representative sample of customers to rank the components from the 'most important' to the 'least important'. Practically, it is difficult, particularly when the number of components is large. Another method is use of rating scale in which the respondents may be asked to place a weight from 1 to 10 against each component according to the importance they attach to each element.
- 3) **Identification of Customer Service Segments** — After determining the importance attached by different respondents to the service attributes, the final step is to see the similarities of preference. One important technique used to identify customer service segments is 'cluster analysis'. It is computer based method for looking into a set of data and try to match respondents across as many dimensions as possible.

Topics covered: COSTS OF CUSTOMER SERVICE

Introduction: All customers do not contribute equally in the profitability of the firm because customers purchase different quantity of different products. A customer can choose an overage service at an average cost, perfect service at an extraordinary high cost or poor service at a very low cost. While formulating customer service strategy, it is essential to have a proper cost-benefit analysis of the service because any increase in the service level will require increase in the costs due to requirement of additional facilities.

Cost Elements While calculating total customer service cost, following elements should be taken into consideration.

- 1) Inventory carrying costs for required level of services to meet unexpectedly high levels of demand.
- 2) Costs incurred in the reduction of cycle time.
- 3) Costs involved in reverse logistics system in case of defective including cost of movement of defective goods from customer and cost of verification.
- 4) Cost involved in the continuous evaluation and appraisal of the system.
- 5) Fixed costs incurred in the development of service consistency like development of information system and internet connectivity.

Hidden costs of customer service: Warren identified that even the best managed firms may have any of the following hidden eleven costs of customer service.

1. Mistake in defining customer service
2. Overlooking customer profitability
3. Using unrealistic customer service policies
4. Failing to research
5. Failure in defining customer service as a sales incentives'
6. Misusing customer service as sales incentives.
7. Failure in defining lines of authority
8. Equating the number of warehouses with customer service
9. Adding bodies rather than systems.
10. Employing under-trained, under-paid people
11. Misreading the seller's market.

Topic covered: Revenue Management

What is revenue management?

Revenue management is defined as the use of differential pricing based on customer segment, time of use and product or capacity availability to increase supply chain surplus. Revenue management has an impact on supply chain profitability if any of the following four conditions exist

1. Value of product varies in different market segments
2. Product is highly perishable
3. Demand has seasonal and other peaks.
4. Product is sold both in bulk and on the spot.

Techniques used in Revenue Management

- 1) **Revenue Management for Multiple Customer Segment** — Most of the situations involve multiple segments of customers each segment having different price elasticity with a different market curve. Differential pricing increases total profit for a firm. Two issues must be handled.
 - a. How can the firm differentiate between the two segments and structure its pricing to market one segment pay more than the other.
 - b. How can the firm control demand such that the lower paying segment does not utilize the entire availability of the assets?
 Let us consider an example of ABC Airlines. It is operating at low capacity and wants to, increase demand by attracting leisure travelers. These travelers are more price conscious. Business travelers cannot plan their travel in advance and want flexibility in cancellation. Since the company pays for the travel, they are less price sensitive. In contrast, leisure travelers make plan in advance and avoid cancellation. On the basis of such services one can distinguish between both customers.
- 2) **Revenue Management under Uncertain Demand and Limited Capacity Situations** — Demand from the segment paying the lower price arises earlier in time than demand from the segment paying higher price. A provider may charge a lower price to a buyer willing to commit in advance and higher price to buyers who place order at the last minute. This requires demand forecasting. Since demands are uncertain therefore it is impossible to predict exact capacity to save for the higher price segment. In our example if we are not careful, we might end up with a situation where the capacity of the plane has been filled with leisure travelers and with not enough seats for the high paying business travelers. Hence, the basic trade off should be considered between committing to an order from a lower price buyer and waiting for a high price buyer to arrive later on. Spoilage risk occurs when the capacity reserved for higher price buyers is wasted because demand does not materialize. On the other hand, spill risk occurs if higher price buyers have to be turned away because the capacity has already been committed to lower price buyers.
- 3) **Revenue Management for Seasonal Demand** — Off-peak discounting is a method of shifting demand from the peak to the off-peak period. From the perspective of revenue management, a higher price is charged during peak period and lower price is charged during off-peak period. Here, the goal is to increase demand during low demand periods by attracting price sensitive customers. It is effective for owners of production of transportation capacity in any supply chain facing seasonal peak capacity.
- 4) **Revenue Management for Inventory Assets** — It is a common practice to produce the entire requirement for the season in one lot. In this case, the salvaging is done only at the end of the season. Markdown can be used to generate higher revenue which influences demand during the reactive part of the season (speculative approach).
 Thus, it is clear from the above discussion that revenue can be maximized by using any tactic. In short, customer segments are identified and expected benefit is quantified before starting the project.