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SCHOOL OF MANAGEMENT STUDIES

UNIT – I – Logistics Management – SBAA7025

I. INTRODUCTION TO LOGISTICS

Logistics - Definition, Evolution, Scope, Functions, Objectives, and Importance-Logistics Integration - Customer Service - phases, service attributes, Value added Logistical Services-Supply Chain Management vs Logistics.

LOGISTICS: CONCEPT, DEFINITION, ORIGIN AND EVOLUTION

Logistics management is the part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption to meet customer requirements.

Logistics management may be defined as follows:

According to the Council of Logistics Management, logistics can be defined as "that part of supply chain process that plans, implements and controls the efficient, effective flow and storage of goods, services and related information from the point of origin to the point of consumption".

Logistics Management is an all-inclusive term that encompasses both planning and execution of four key aspects of logistics, i.e. transportation, distribution, warehousing and purchasing. Another pertinent factor that logistics management takes into account is the flow of goods in forward and reverse order.

Logistics management consists of the process of planning, implementing and controlling the efficient flow of raw-materials, work-in-progress and finished goods and related information- from point of origin to point of consumption; with a view to providing satisfaction to the customer.

Origin and Evolution:

- **Years 30 "Military logistics"**

After the Second World War, the interest of business by the logistics process arises and an analogy is established between military logistics and technical material supply and military logistics is begun to be related to industrial production.

- **Years 50 "Conceptualization of logistics"**

Logistics becomes more important due to the transition that goes through the most developed countries, from an economy characterized by excessive demand to an economy with excess supply, with these being their main characteristics:

- First developments of the total cost of logistics operations.
- It focuses on the concern to satisfy the customer.
- Distribution channels are of particular importance. You want to sell any product anywhere.
- Increase new products, as a result the product lines are originated.

- **60 Years "Outsourcing"**

Logistics took a new approach where "outsourcing" was the most appropriate mechanism to reach customers, since it had as its main objective the subcontracting of other companies because the flow of goods or information was efficient and reached all parts that were within the reach of the company.

- **Years 70 "The concept of trial logistics"**
  - Customer service becomes an indispensable requirement to continue competing with market leaders.
  - Progress in the concept of physical distribution.
  - There are periods of recession and growth in the world economy.
  - Development of the inventory management strategy.
  - The technology for the industrial revolution that occurred during these times began to emerge, and the cost of information technology was reduced to improve the quality, which brought about an improved mechanism for the supply of the goods Or information accurately and precisely at the time the customer made their order, this mechanism is called "Just in Time", that is just in time

- **Since the 80's "Modification of preferences"**
  - The energy crisis of the moment drives the movement towards the improvement of transport and storage.
  - Just in Time's approach was modified by Quick Response (QR) and Efficient Consumer Response (ECR) with the sole purpose of seeking a precise delivery with the exact amount, when and where needed, to meet To the customer.
  - Changes in supply chain preferences where special attention is paid to suppliers,

distributors and customer service, defining the end-user's demand.

- Inventories, total logistics costs are reduced, and delivery times are shorter.
- Logistics operations are energy-intensive: environmental-ecological concern is born.

- **1990 "Promotion of logistics"**

Logistics went on to become a more integrated process in terms of its external and internal environment, in other words, its internal processes within the company were managed according to the relationships that were with its customers and suppliers.

This process of integration causes logistics management to begin with a strategic plan regarding the design of how to reach the final customers, in order to go out and minimize competition, establishing efficient plans for the supply of the products.

- Technology continues to position itself in conventional Logistics processes and Distribution channels
- Outsourcing services
- Demand for logistics services expands

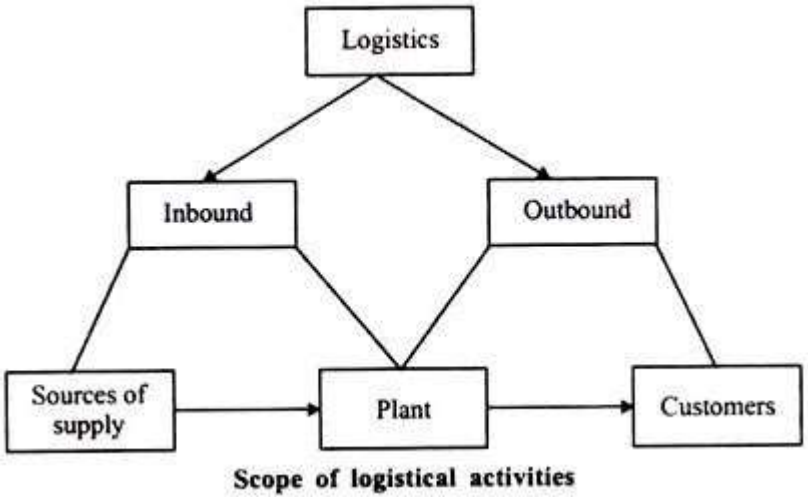
Day by day it is observed that to put into practice a good business logistics management is essential, it has developed over time and is now a basic aspect. A perfectly designed logistics project is the most strategic tool to compete with the demanding current market, achieving customer loyalty.

Classification of Logistical Activities:

Logistics (or Logistical Activities) may be broadly classified into two categories:

I. Inbound logistics; which is concerned with the smooth and cost effective inflow of materials and other inputs (that are needed in the manufacturing process) from suppliers to the plant. For proper management of inbound logistics, the management has to maintain a continuous interface with suppliers (vendors).

II. Outbound logistics (also called physical distribution management or supply chain management); is concerned with the flow of finished goods and other related information from the firm to the customer. For proper management of outbound logistics, the management has to maintain a continuous interface with transport operators and channels of distribution.



Scope of logistical activities

Significance (or Objectives) of Logistics Management:

Logistics management is significant for the following reasons:

(i) Cost Reduction and Profit Maximization:

Logistics management results in cost reduction and profit maximization, primarily due to:

1. Improved material handling
2. Safe, speedy and economical transportation
3. Optimum number and convenient location of warehouses etc.

(ii) Efficient Flow of Manufacturing Operations:

Inbound logistics helps in the efficient flow of manufacturing operations, due to on-time delivery of materials, proper utilization of materials and semi-finished goods in the production process and so on.

(iii) Competitive Edge:

Logistics provide, maintain and sharpen the competitive edge of an enterprise by:

1. Increasing sales through providing better customer service
2. Arranging for rapid and reliable delivery
3. Avoiding errors in order processing; and so on.

(iv) Effective Communication System:

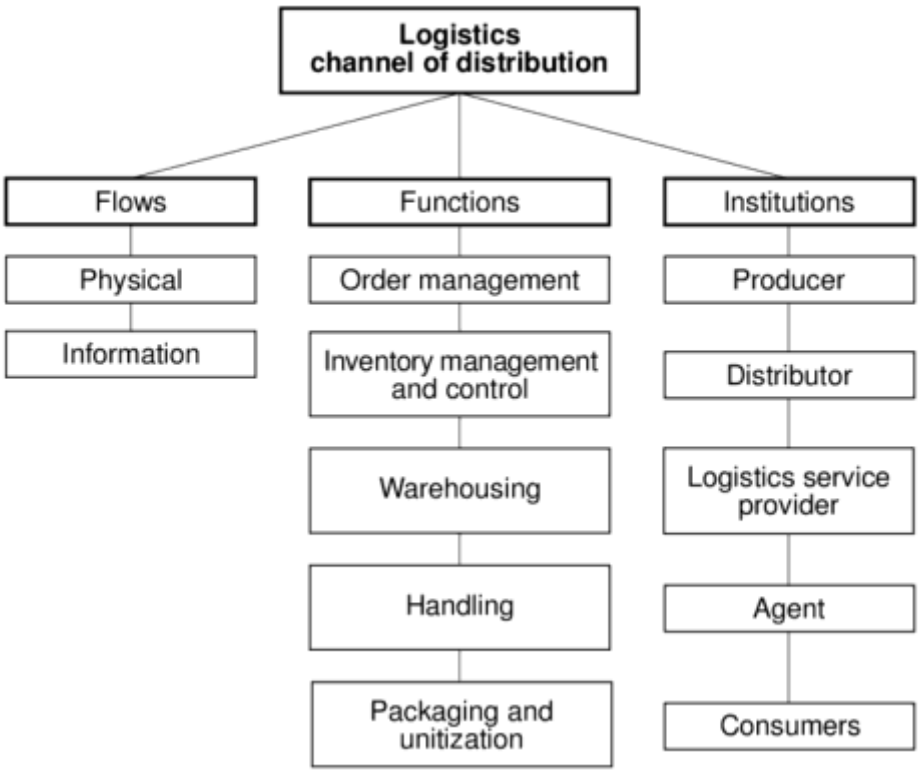
An efficient information system is a must for sound logistics management. As such, logistics management helps in developing effective communication system for continuous interface with suppliers and rapid response to customer enquiries.

(v) Sound Inventory Management:

Sound inventory management is a by-product of logistics management. A major headache of production management, financial management etc. is how to ensure sound inventory management; which headache is cured by logistics management.

FUNCTIONS OF LOGISTICS:

Logistics is a process of movement of goods across the supply chain of a company. However, this process consists of various functions that have to be properly managed to bring effectiveness and efficiency to the supply chain of the organization.



- **Order Processing:** Customers' orders are very important in logistics management. Order processing includes activities for receiving, handling, filing, recording of orders. Herein, management has to ensure that order processing is accurate, reliable and fast. Further, management has to minimize the time between receipt of orders and date of dispatch of the consignment to ensure speedy processing of the order. Delays in execution of orders can become serious grounds for customer dissatisfaction; which must be avoided at all costs.
- **Inventory Management:** The basic objective of inventory management is to

minimize the amount of working capital blocked in inventories; and at the same time to provide a continuous flow of materials to match production requirements; and to provide timely supplies of goods to meet customers' demands.

- **Warehousing:** Warehousing is the storing of finished goods until they are sold. It plays a vital role in logistics operations of a firm. The effectiveness of an organization's marketing depends on the appropriate decision on warehousing. In today's context, warehousing is treated as switching facility rather than a storage of improper warehousing management. Warehousing is the key decision area in logistics.

The major decisions in warehousing are:

- Location of warehousing facilities
- Number of warehouses
- Size of the warehouse
- Warehouse layout
- Design of the building
- Ownership of the warehouse

- **Transportation:** For movement of goods from the supplier to the buyer, transportation is the most fundamental and important component of logistics. When an order is placed, the transaction is not completed till the goods are physically moved to the customer's place. The physical movement of goods is through various transportation modes. In logistics costs, its share varies from 65 to 70 percent in the case of mass-consumed, very low unit-priced products. Firms choose the mode of transportation depending on the infrastructure of transportation in the country or region. Cost is the most important consideration in the selection of a particular mode of transport. However, sometimes urgency of the good at the customer end overrides the cost consideration, and goods are sent through the fastest mode, which is an expensive alternative.
- **Material Handling and storage system:** The speed of the inventory movement across the supply chain depends on the material handling methods. An improper method of material handling will add to the product damages and delays in deliveries and incidental overheads. Mechanization and automation in material handling enhance the logistics system productivity. Other considerations for selection of a material handling system are the volumes to be handled, the speed required for material movement and the level of service to be offered to the customer. The storage system is important for

maximum space utilization (floor and cubic) in the given size of a warehouse. The material handling system should support the storage system for speedy movement (storage and retrieval) of goods in and out of the warehouse.

- **Logistical Packaging:** Logistical or industrial packaging is a critical element in the physical distribution of a product, which influences the efficiency of the logistical system. It differs from product packaging, which is based on marketing objectives. However, logistical packaging plays an important role in damage protection, case in material handling and storage space economy. The utilization of load has a major bearing on logistical packaging with regard to the packaging cost.
- **Information:** Logistics is basically an information-based activity of inventory movement across a supply chain. Hence, an information system plays a vital role in delivering a superior service to the customers. Use of IT tools for information identification, access, storage, analysis, retrieval and decision support which is vital among the functions of logistics is helping business firms to enhance their competitiveness.

INTEGRATED LOGISTICS MANAGEMENT

The movement of raw materials and components to a manufacturing company must be managed. So must the movement of finished goods from the manufacturing plant to further processing, to the retail, or to the final consumer. The management of this movement is called **integrated logistics management**.

Integrated Logistics is defined as, "the process of anticipating customer needs and wants; acquiring the capital, materials, people, technologies and information necessary to meet those needs and wants optimizing the goods-or-service-producing a network to fulfill customer requests; and utilizing the network to fulfill customer request in a timely way."

Integrated logistics is a service-oriented process. It incorporates actions that help move the product from the raw material source to the final customer.

Variables affecting the Evaluation and Growth of Integrated Logistic:

- The first was the growth of the consumer awareness and the marketing concept. Product line expanded to meet the rising demand for more selections. This

product line expansion put great presser on distribution channels to move more products and keep cost down, especially in transportation and inventory.

- A second factor was the introduction of the computer. Computer experts and integrated logistic manager quickly found a multitude of computer application for logistic. This application offered still greater efficiency in transportation routing and scheduling, inventory control, warehouse layout and design, and every aspect of integrated logistic. In fact computers allowed integrated logistic managed to modal integrated logistic system and then analyse the effect of proposed change. This application greatly advance the system's approach

- The third variable leading to the growth of integrated logistics was the worldwide economy in the 1970s and 1980s. Global recession and rising interest rates caused many firms to refocus attention on reducing cost advantage; many firms were forced to revaluate overall transportation needs. Also, rising interest rates turned attention to maintaining minimum inventory levels because of the cost of capital

- Globalization of business and the development of world trade blocks are a fourth factor influencing the growth of integrated logistics. Integrated logistic can provide firms with a cost advantage. Furthermore, trading blocks in Europe. Southeast Asia, Asia, Africa and the Americans (European Union, association of Southeast Asian nations and the Asian- pacific economic cooperation, southern African development community, North American free trade agreement and now the free trade agreement of the Americas) require integrated logistics to tie the participating countries into single marketplaces.

- The final factor affecting integrated logistics is the growth of just-in-time manufacturing (JIT), supply management, transportation, and electronic data interchange (EDI) in the 1980s and 1990s. As manufacturers adopted total quality management (TQM), JIT, and EDI, **integrated logistics management** has come to the forefront. Effective TQM and JIT require optimizing the inbound and outbound transportation and more efficient inventory management.

Activities related to integrated logistics:

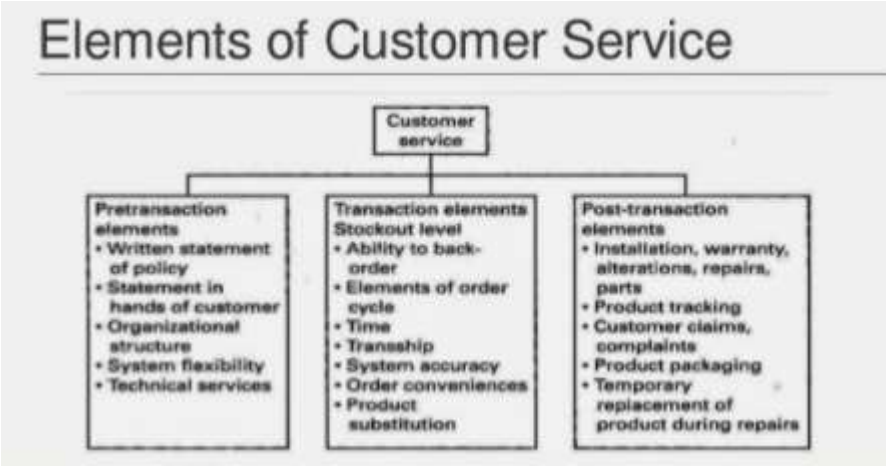
- Physical distribution.
- Materials management.
- Logistics engineering.
- Business logistics.
- Logistics management.
- Integrated logistics management.
- Distribution management.
- Supply chain management.

Although the activities include under each term vary, they share one key ingredient: "The concept of a continuous uninterrupted flow of the product."

Phase in Customer Service:

Customer service is the measure of how logistics is creating the time and place utility for a product. The meaning of customer service varies with the organization the product, it is marketing and the transaction phase it is undergoing the buyer looks for value for the money spent. While the seller, in delivering superior customer service, looks for the trade-off between cost and customer satisfaction.

Hence, customer service depends on the phase of the transaction it is passing through. There are three phases associated with the exchange process. The degree of importance of each phase varies with the organization and depends on the product and customer requirements.



Pre-transaction phase:

This phase pre-transaction which is more related to policy for defining the service level and related activities in qualitative and quantitative terms. It is a non-routine activity. It gives the guidelines to the operating people regarding the dimensions and limitations of customer service activities of the firm.

The pre-transaction phase is a creation of the service platform to serve the customer, so as to build credibility in the market and rate a good image among the existing and prospective customers. This is an important phase of the exchange process, which will help to mold the organization toward customer orientation and in turn influence the perception of the firm in the mind of the customer.

Typically, the following are important elements of the pre-transaction phase.

- **Customer service policy:** This will indicate the service standards of the firm. Further, they commit to offer free supply, in a case of the parts reach their destination after the stipulated delivery period. In this phase, the firm will have to evolve a policy framework for performance measures, evaluation methods, reporting structure, and the reward structure.

- **Organization building:** For implementing the policy directives on customer service, the firm should formalize the porting structure, delegate authority, and allocate responsibility. The contact person's name and contact number need to be communicated to the customers for information on order status, dispatch details, warranty claims, and so forth. A proper reward system will motivate the employee involved in customer service to effectively and efficiently interface

with the customer.

- **Structuring the service:** The basic structure of the service depends on customer expectations, industry standard, and the service standard the firm would like to keep. The firm marketing capital goods may evolve a service structure to extend lifetime product service commitments for the supply of spares, irrespective of continuous product and technology upgrades at its end. The supplier may extend a free periodic product check-up service to clients to gain a competitive edge. In such case, he/she may absorb all service- related costs as a value-added free service to the client. In the maturity stage of the product lifecycle, when competition is fierce the firm needs to customize the service to strategic clients or to a section of clients in the niche segments.

- **Customer education:** This is required for minimizing customer complaints on product deliveries, product operations and maintenance, spare parts inventory requirements, and maintenance, freight charges, transit damages, and more. Customer education is done through manuals, training, seminars, and workshops.

- **System design:** System configuration should take care of active customer service to answer all possible queries in the customer's mind before placing an order. The system may be manual or fully automatic as in e-commerce. However, a prerequisite of the system in a competitive environment is responsiveness to customer requirements and the flexibility to take care of unplanned events with knowledge of pre-transaction phase is nothing but inevitable if you want to build a strong customer service.

Transaction phase:

Customer service during the transaction phase is associated with routine tasks performed in the logistics supply chain. These tasks need coordination for the entire system to be efficient and effective in delivering service to the customer per the desired standard.

The following are the various service elements associated with the transaction phase:

- **Order fulfilment reliability:** In the transaction phase, the most important factor is the reliability to fulfil the order within the agreed time frame and also with

respect to the quantity and quality of the material ordered. This depends on the close coordination and management of the various components of the order cycle such as order processing, material planning allocation, picking, packing, and transportation. The customer's production schedule is very much dependent on the reliability factor of order fulfillment by the supplier.

- **Delivery consistency:** The other important factor in the transaction phase is the consistency of delivery of repeat orders. Let's say out of 100 deliveries only 60 are on time while 40 deliveries deviate from the agreed schedule. Now, this likely to cause production interruptions at the customer's end, and the customer will surely be dissatisfied with such inconsistencies. The inconsistency of delivery may be because of problems with the various elements of order fulfillment that need system improvement as well as for better supply chain management.
- **Order convenience:** Order convenience is the ease with which the customer can place an order. The barriers to convenience are the paperwork required by the supplier, compliance to various procedures complex payment terms poor communication network at the supplier's end, and poor coordination in the marketing network of the supplier. In competitive markets, these barriers may lead to opportunity loss and warning of the customer base.
- **Order postponement:** The customer, for some reason, may require an entire order or a part thereof to be postponed or executed in parts, in a phased manner. This may be due to the rescheduling of requirements at the customer's end. In another case, due to the availability of a certain product category in the future, the seller may ask the buyer to place the order now and ship the product when it is available on future dates.
- **Product substitute:** A situation may arise that the product ordered can't be shipped due to certain manufacturing or quality problem. The seller may extend the service by offering a substitute product of similar or better quality in different sizes or from the available brands in the market (on the same terms and conditions) in order to keep the relationship and retain the customer during transaction phase. For obtaining the customer's consent for a product substitute, the seller needs closer interaction and clear communication with the customer. So all of these are very important in customer service.

Post-Transaction phase:

This phase releases primarily to customer satisfaction and building a long-term relationship with the customer. It involves the commitment of resources to offer the desired level of service. For service-based products, a post-transaction phase is an important phase dependent, on the quality, which may make the image of a company in the minds of their customers.

- **Order status information:** In e-commerce business-to-business transactions, the customer, after payment of part value (sometimes full value) of the product as an advance, requires continues feedback on the status of the shipment.
- **Customer complaints, claims, and returns:** The seller's responsibility is not over after a product is dispatched to the client. The customer may have received products that were damaged during transit, or the product may not perform as per the functional requirement, or the client may have gotten the wrong consignment. For resolving these issues, the manufacturer normally evolves a product return policy and implements it through the reverse logistics system.
- **Product installation, commissioning and technical snags:** Technically complex products need installation, commissioning and stabilization services from suppliers, or else the product might develop technical snags during the warranty period. To handle these issues, firms normally have a separate set-up for after sales service. The after sales department takes care of all documentation customer technical complaints, product installation, commissioning stabilization and handing over.
- **Customer education and training:** Customer education and training is an important service element in the post-transaction phase. In the case of technically complex products, it is necessary for the seller to train or educate the user in their operation to get the desired functional output in supply chain management. This may be done through product manuals, training workshops, or demonstrations to improve customer service.

Customer service attributes (Distribution aspects):

The most important and critical aspect of customer service in supply chain management is physical distribution of the product, that is, making the right product available at the right place and the right time, followed by the motivation of service success facilitators such as channel members to complete the physical distribution. This is a vital point for supply chain management.

Order processing time: Order process time is the most important measure of customer service in physical distribution. It is the time between the placement of an order by the buyer and the supply of the material by the seller against and order. This involves the supply of all the material against the order placed within the agreed time frame, without any error either in documentation or physical supply. This customer service attributes helps in building a long term buyer-seller relationship.

The order processing time consists of the time required for registration of the order in the supplier's system after through technical and commercial scrutiny, material allocation and pickup from the work in progress inventory, warehouse or distribution centers; packing of material; documentation; and dispatch of material. The time consumed in each of these activities will depend on how well coordinated the various departments are and the speed of the information flow across the logistics supply chain.

Delivery consistency: This refers to the consistency in maintaining the same delivery period for delivering the material to the buyer over a period of time. For example, if the supplier dispatches the material per the agree delivery time for 97 orders against 100 repeat orders received during the year t may be said that the supplier's delivery consistency is 97 percent, and per the present industry norms it is an excellent delivery performance.

Delivery consistency speaks of the degree of coordination in the various logistics arms of

the seller's firm and the efficiency and effectiveness of the logistical supply chain. The delivery consistency of suppliers has a direct effect on the inventory level at the buyer's end. Inconsistency in deliveries may force the buyer to carry an excess inventory of raw materials and components as a precautionary measure and thereby block more funds. Subsequently, the buyer may look for an efficient source of supply to get rid of the inventory problem. The delivery consistency of suppliers has a direct effect on the inventory level at the buyer's end. Inconsistency in deliveries may force the buyer to carry an excess inventory of raw materials and components as a precautionary measure and thereby block more funds. Subsequently, the buyer may look for an efficient source of supply to get rid of the inventory problem.

Delivery frequency: The frequency of delivery is the key element in customer service. The customer does not want to carry an excess inventory but wants his operations to run without interruptions. As a result, the customer prefers frequent deliveries in small lots. This may increase transportation cost, but it reduces the inventory related cost drastically with the net result being a reduction in the overall supply chain cost.

Stock availability: Stock availability is an important measure of customer service. With excess stocks, the supplier may extend an excellent service to the customer, but inventory related cost reduces the profit margin of business operations. Hence the firm needs to strike a balance between the inventory level and the desired customer service level through integrated logistics operations.

VALUE ADDED SERVICE IN LOGISTICS – CONCEPT:

V**alue-added logistics (VAL)** is a term used within the sector. This allows for a **more comprehensive service** and is an essential tool for **increasing customer satisfaction**. This is especially important when it comes to certain operations based on the trust that a customer places in a company. It is the creation of a higher added value in the logistics chain. Every transport company can move products from A to B, but it is difficult to stand out with that in a market full of competition. Carriers therefore provide an increasing number of services: not only do they organize transport; they also pack, weigh and label the products.

Value added – role of logistics:

- **Form Utility:** It refers to the value added to goods through a manufacturing, production or assembling process. For example, form utility results when raw materials are combined in some predetermined manner to make a finished product. The simple process of adding the raw materials together to produce the soft drink represents a change in product form that adds value to the product.
- **Place Utility:** Logistics provides place utility by moving goods from production surplus points to points where demand exists. Logistics extends the physical boundaries of the market area, thus adding economic value to the goods. This addition to the economic value of goods and services known as place utility.
- **Time Utility:** Not only must goods or services be available whenever consumers need them, but they must also be at that point when customers demand them. This is called time utility or the economic value added to a good or service by having it at a demand point at a specific time. Logistics creates time utility through proper inventory maintenance and the strategic location of goods and services. For example, logistics creates time utility by having heavily advertised products and sales merchandise available in retain stores at precisely the time promised in the advertising effort.
- **Possession Utility:** It is primarily created through the basic marketing activities related to the promotion of products or services. We may define promotion as the effort, through direct and indirect contact with the customer, to increase the desire to possess a good or to benefit from a service. The role of logistics in the economy depends upon the existence of possession utility, for time or place utility make sense only if demand for the product or service exists.

Value added – functions:

Efficient logistics contributes to added-value in four major interrelated ways:

- **Production costs:** Derived from the improved efficiency of manufacturing with appropriate shipment size, packaging and inventory levels. Thus, logistics contributes to the reduction of production costs by streamlining the supply chain.
- **Location:** Logistics adds value by taking better advantage of various locations, implying access to expanded markets (more customers) and lower distribution costs.

- **Time:** Added value derived from having goods and services available when required along the supply chain (e.g. lower lead times) with better inventory and transportation management.
- **Control:** Added value derived from controlling most, if not all, the stages along the supply chain, from production to distribution. By better synchronizing cycles and lead times, logistics enables better marketing and demand response, thus anticipating flows and allocating distribution resources accordingly.

BASIS FOR COMPARISON	LOGISTICS MANAGEMENT	SUPPLY CHAIN MANAGEMENT
Meaning	The process of integrating the movement and maintenance of goods in and out the organization is Logistics.	The coordination and management of the supply chain activities are known as Supply Chain Management.
Objective	Customer Satisfaction	Competitive Advantage
Evolution	The concept of Logistics has been evolved earlier.	Supply Chain Management is a modern concept.
How many organizations are involved?	Single	Multiple
One in another	Logistics Management is a fraction of Supply Chain Management.	Supply Chain Management is the new version of Logistics Management.

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SCHOOL OF MANAGEMENT STUDIES

UNIT – II – Logistics Management – SBAA7025

II. LOGISTICS ACTIVITIES

Marketing and Logistics - Relationship of logistics to Marketing and Production, Logistics and Modern Organization - Elements of Logistics - Trade-off Analysis - Types of Trade-off Analysis - Logistics Outsourcing - Third party logistics, Fourth party Logistics.

MARKETING AND LOGISTICS – CONCEPT:

The importance of a logistics system lies in the fact that it leads to ultimate consummation of the sales contract. Delivery according to the contract is essential to fulfilling the commercial and legal requirements. In the event of failure to comply with the stipulated supply of period, the seller may not only get his sale amount back, but may also be legally penalized, if the sales contract so specifies. There is no doubt that better delivery schedule is a good promotional strategy when buyers are reluctant to invest in warehousing and keeping higher level of inventories. Similarly, better and timely delivery helps in getting repeat orders through creation of goodwill for the supplier. Thus, as effective logistics system contributes immensely to the achievements of the business and marketing objectives of a firm. It creates time and place utilities in the products and thereby helps in maximizing the value satisfaction to consumers. By ensuring quick deliveries in minimum time and cost, it relieves the customers of holding excess inventories. It also brings down the cost of carrying inventory, material handling, transportation and other related activities of distribution. In nutshell, an efficient system of physical distribution logistics has a great potential for improving customer service and reducing costs.

Logistics has gained importance due to the following trends

- Rise in transportation cost.
- Production efficiency is reaching a peak
- Fundamental change in inventory philosophy
- Product line proliferated
- Computer technology
- Increased public concern of products growth of several new, large retail chains
- Reduction in economic regulation
- Growing power of retailers
- Globalization

As a result of these developments, the decision maker has a number of choices to work out the most ideal marketing logistics system. Logistics is also important on the global scale. Efficient logistics systems throughout the world economy are a basis for trade and a high standard of living for all of us. Lands, as well as the people who occupy them, are not equally productive. That is, one region often has an advantage over all others in some production specialty. An efficient logistics system allows a geographical region to exploit its inherent advantage by specializing its productive efforts in those products in which it has been an advantage by specializing its productive to other regions. The system allows the products landed cost (production plus logistics cost) and quality to be competitive with those form any other region. Common examples of this specialization have been Japan's electronics industry, the agricultural, computer and aircrafts industries of United States and various countries dominance in supplying raw materials such as oil, gold, bauxite, and chromium.

OBJECTIVES OF MARKETING LOGISTICS:

The General objectives of the logistics can be summarized as:

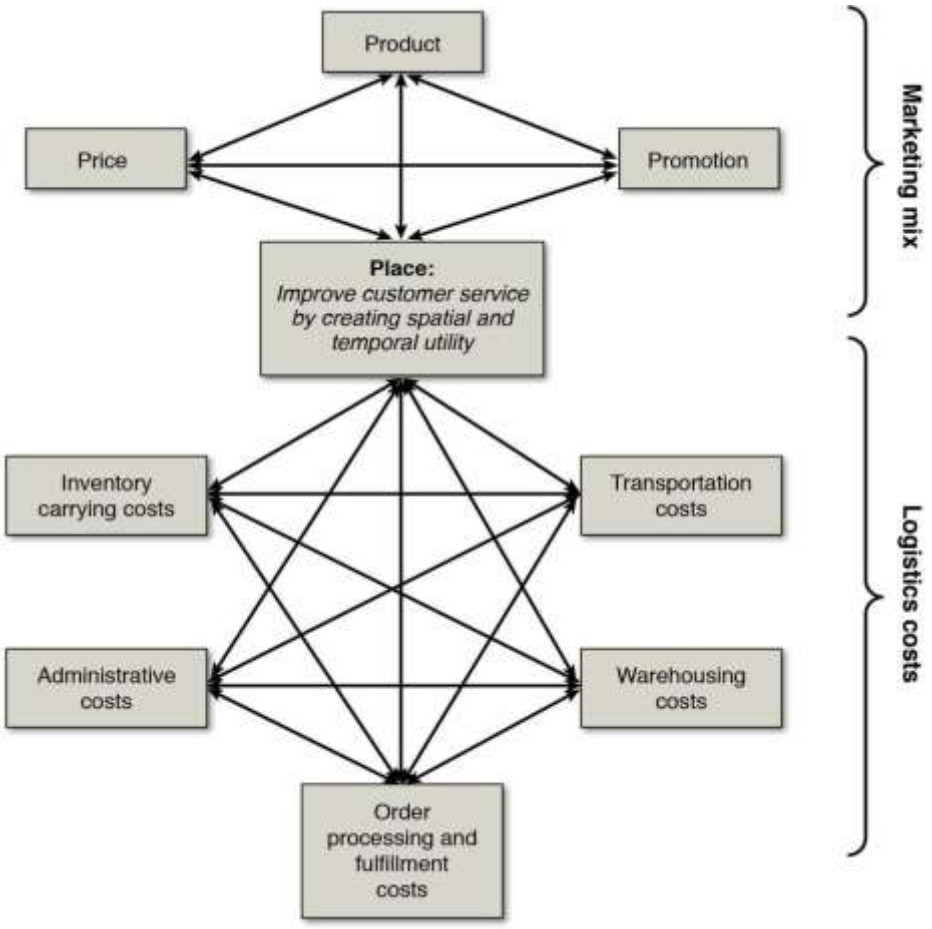
1. Cost reduction
2. Capital reduction
3. Service improvement

The specific objective of an ideal logistics system is to ensure the flow of supply to the buyer, the:

- Right product
- Right quantities and assortments
- Right places
- Right time
- Right cost / price and,
- Right condition

This implies that a firm will aim at having a logistics system which maximizes the customer service and minimizes the distribution cost. However, one can approximate the reality by defining the objective of logistics system as achieving a desired level of customer service i.e., the degree of delivery support given by the seller to the buyer. Thus, logistics management starts with as curtaining customer need till its fulfillment through product supplies and during this process of supplies it considers all aspects of performance which

include arranging the inputs, manufacturing the goods and the physical distribution of the products.



SCOPE OF THE MARKETING LOGISTICS:

The development of interest in logistics after industrial revolution and World War II contributed to the growth in scope of logistical activities. The following areas are the major scope of logistics:

- Demand forecasting
- Distribution communication
- Inventory Control
- Material Handling
- Order Processing
- Part & Service Support
- Plant and Warehouse side selection
- Procurement
- Packaging
- Salvage & scrap disposal

- Traffic & transportation
- Warehousing & Storage
- Time & Place Utility
- Efficient Movement to Customer
- Return goods handling
- Customers Service

LOGISTICS AND MARKETING INTERFACE:

Integration of different processes and logistic functions in the framework of logistic system and logistics management, as well as integration of this system with marketing system in scale of a company and market is reflected in an integrated concept of logistic-marketing management, constituting fundamental aspect of modern company management.

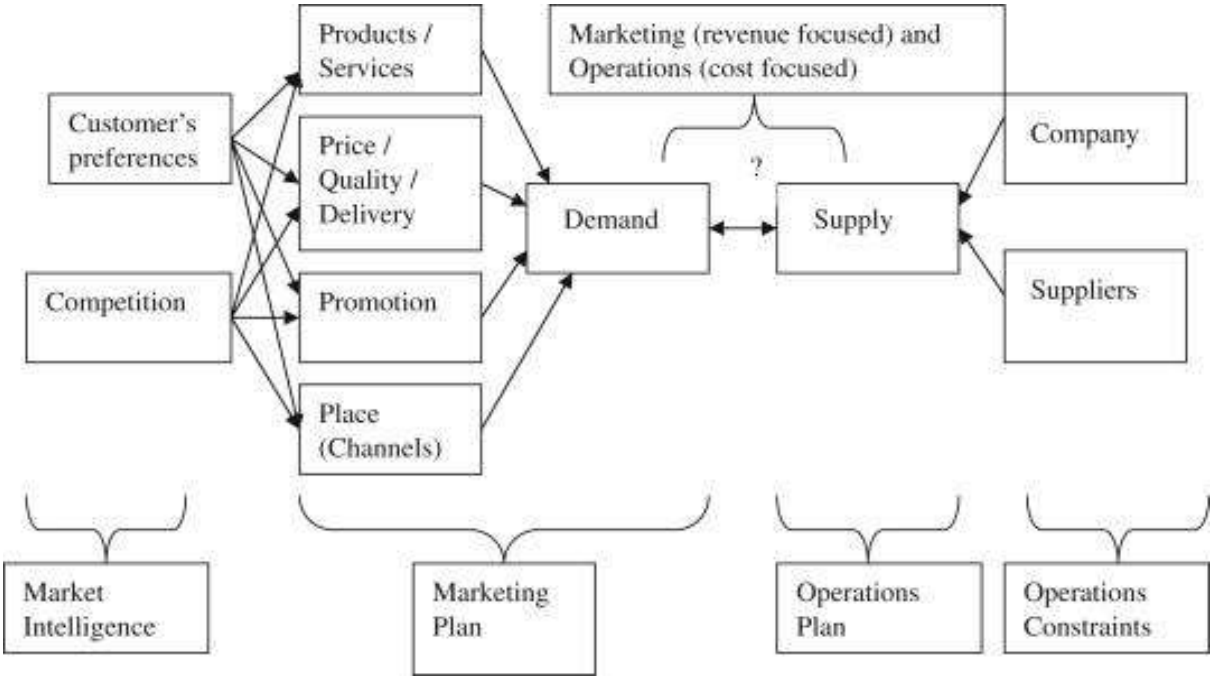
Logistic-marketing management constitutes linkage and integration of two concepts, on one side - logistics as a management concept oriented on flows, and marketing as a concept oriented on company management, on the other. Both mentioned management concepts meet on very fragile ground which is market, determining a strategy of company's acting on delivery and distribution market. Present logistics and marketing are treated as dual concepts of integrated company management. Logistics and marketing are defined as main orientations (criteria) of management in a company and interpreted in the real sense as significant (equivalent) spheres of functional and integrated processes in company. Preparing a strategy of a company, special attention should be paid to the relation between logistic and marketing strategies. If marketing is identified with strategic management, then logistics is a part of it. In a modern company marketing must be logistic, logistics must be marketing, Kotler (1998).

In the modern concept of logistic-marketing management on one side, customer satisfaction is achieved by coordinated marketing activities concerning product, price, promotion and distribution by offering to customer by logistics time and place usefulness. On the other side, achieving by company an acceptable level of profit in long time is determined by reduction of global logistic costs. An effect of strategic logistic activity is a group of values and benefits achieved by customer. It is described

as “7P” formula of logistic activity: proper product, proper information, proper amount, proper quality, proper time, proper place, and proper cost of order.

RELATIONSHIP OF LOGISTICS TO MARKETING AND PRODUCTION:

Organizations are recognizing the importance of integrating their marketing and logistics activities. According to recent trade publications, "whatever the definition, warehousing and distribution are critical to the successful marketing of products: if the product is not where customers want it, when they want it, it is unlikely to sell."



Also, the quality of incoming materials and parts obtained through purchasing often determines the quality of finished goods for sales and distribution. Thus, purchasing is tied to production, marketing, and logistics. In particular, logistics is closely linked to marketing through their roles in customer services. Production logistics aims to ensure that each machine and workstation receives the right product in the right quantity and quality at the right time. The concern is with production, testing, transportation, storage and supply. Production logistics provides the means to achieve customer response and capital efficiency.

The relationship between marketing and logistics management:

logistics affects the market marketing, marketing facilitator logistics, in order to

achieve marketing, meet customer demand, improve effectively, make the product value to maintain customer loyalty and so on all need to be adjusted, logistics and marketing. The objectives of these factors are too; Simplify the task of generating and processing technical data through; Better packaging, eliminating redundancies, reducing processing time, and accessible of information to all organizations.

ELEMENTS OF LOGISTICS

The role of each element of logistics often defines the logistics activities within a supply chain.

The problem with definitions and discussions of supply chains is that it is not easy to recognize the role of logistics within them, which is why the supply chain river is a simple way to relate the role of logistics within a supply chain. The elements of logistics further help to explain what logistics activities and processes are being undertaken in a supply chain.

There are five elements of logistics:

- Storage, warehousing and materials handling
- Packaging and unitization
- Inventory
- Transport
- Information and control

Let's break this down:

- **What is the role of storage, material handling and warehouses in logistics?**

It is to enable a steady stream of products to be supplied by manufacturers. Why is this important? Manufacturers need to operate at peak efficiency, but consumers tend not to demand goods at the same rate as a manufacturer supplies them. There tends to be an imbalance between supply, which is steady, and demand, which can be unpredictable. The answer is to store the surplus goods produced by a manufacturer until they are demanded by consumers. To achieve this, warehouse buildings are required. These need specialist storage equipment such as shelving or racks and material handling equipment to move them around the warehouse and to load and unload delivery vehicles.

- **What is the role of packaging and unitization?**

A key definition and one of the Rs of logistics is the care and condition of a product. Packaging is an essential part of that. Unitization is also important as this assists storage and transportation. The easiest product to move and store is a cube, so packaging and unitization attempts to take all different sizes and shapes of product and pack them as near as possible into a cuboids shape.

- **What is the role of inventory?**

Inventory is a logistics element that is closely related to storage and warehousing. It is concerned with what stock to hold, where the stock is located and how much stock to hold. In effect, inventory is controlling the flows of goods going into and out of a warehouse. How is this achieved? By looking at sales data of past orders and using various mathematical and statistical tools to attempt to predict how much goods will be demanded by consumers. Inventory management is not an exact science, but depending on how variable demand can be, it is a useful tool to help manage the flows of goods through the supply chain.

- **What is the role of transport?**

A major element of logistics that most will recognize is transport. This includes all modes of transport including road vehicles, freight trains, cargo shipping and air transport. Without transport, goods would be unable to move from one stage to another within a supply chain. Some goods with short supply chains, such as foods, do not travel far. Other more complex products consist of many components that can be transported from all over the world.

- **What is the role of information and control?**

The element of information and control is needed by all the elements to act as triggers to various operational procedures. We have mentioned the information needed for inventory. Order levels help decide what orders need to be picked and packed in warehouses and enable the planning and organisation of transport. Information and control's role is to help design information systems that can control operational procedures. They are also key in the forecasting of demand and inventory as already mentioned.

TRADE-OFF ANALYSIS – CONCEPT

The **trade-off** is a situation that involves losing one quality, aspect or amount of something in return for gaining another quality, aspect or amount. A **trade-off** (or **tradeoff**) is a situational decision that involves diminishing or losing one quality, quantity or property of a set or design in return for gains in other aspects. In simple terms, a **trade-off** is where one thing increases and another must decrease. The definition of **trade-off** is an exchange where you give up one thing in order to get something else that you also desire.

Trade-off analysis is a family of methods by which respondents' utilities for various product features (usually including price) are measured. In some cases, the utilities are measured indirectly. In this case, respondents are asked to consider alternatives and state a likelihood of purchase or preference for each alternative. As the respondent continues to make choices, a pattern begins to emerge which, through complex multiple regression (and other) techniques, can be broken down and analyzed as to the individual features that contribute most to the purchase likelihood or preference.

The importance or influence contributed by the component parts. i.e., product features, are measured in relative units called "utils" or "utility weights. “In other cases, respondents are asked to tell the interviewer directly how important various product features are to them. For example, they might be asked to rate on a scale of 1 to 100 various product features, where 1 means not at all important to their purchase decision and 100 means extremely important to their purchase decision. Trade-off analyses produce several types of information. First, they tell us what features (and levels of features) are most valued by customers. Second, they allow us to model how likely people will be to purchase various configurations of products, the share of revenue these products will most likely receive and what role price plays in the assessment of acceptability.

THE FOUR MAIN TYPES OF TRADE-OFF ANALYSIS:

I. Conjoint

Conjoint analysis is the original trade-off approach and uses linear models. There is metric conjoint, where respondents monadically rate various product configurations, and non-metric conjoint, where respondents rank a set of product configurations. There are also full-

profile conjoint, partial-profile conjoint and pairwise conjoint. Full-profile conjoint uses all product features in every product configuration. Partial profile conjoint uses a smaller subset of available product features in the product configurations. Pairwise conjoint requires the respondent to rate their preference for one product over another in a paired comparison. Typically, each respondent rates or ranks 20 to 30 product configurations. Each product configuration contains different levels of the product attributes being tested. If the product levels are varied appropriately (the role of experimental design), a regression model can be estimated for each individual, using the product ratings as cases. The coefficients from the model are the utilities or utils.

A conjoint approach should be used if a limited number of attributes needs to be tested and utilities need to be estimated for individual respondents, e.g., conjoint-based segmentation.

II. Discrete Choice

Discrete choice differs from conjoint in that respondents are shown a set of products from which they pick the one they most want to buy or none if they are not interested in any of the choices shown (rather than rate or rank choices). Respondents are shown several sets of choices sequentially. For each choice set, they are asked to pick one or none. This is in contrast to most forms of conjoint where respondents are not allowed to choose none of the product options (MACRO incorporates no-buy choices into its conjoint models). The discrete choice procedure has the advantage of being more like the actual purchase decision process than does any of the data collection methods used in most conjoint studies.

Also, in conjoint methods, the mathematical models constructed to simulate market behavior are based on linear regression models. In discrete choice, the basis is the multinomial logit model, which is non-linear. Another analytical difference is that, in conjoint procedures, the utility weights are estimated for each respondent individually. These weights can often provide the basis for very powerful customer segmentation. Most commercially available forms of discrete choice do not allow this option, although this may be rapidly changing.

Further, because discrete choice models are generally estimated at the aggregate level, there exists the possibility that respondents will have strong but opposite preferences to one another. These preferences will effectively cancel each other out when the model is

constructed at the aggregate level, yielding the incorrect conclusion that respondents had no strong preference. This is sometimes referred to as the heterogeneity problem.

There are two basic forms of discrete choice: classic and exploding data.

Classic discrete choice involves showing a respondent a series of sets of products (as described above). In exploding data discrete choice, respondents are asked to rank order a set of products based on purchase interest (similar to non-metric conjoint). This rank-ordered data set can be transformed into a format suitable for logit model estimation. Exploding data discrete choice has the advantage of more efficient data collection over classic discrete choice. The exploding data approach creates many times more data points (or cases) than the classic approach with the same interview length.

Discrete choice should be used if the primary objective of the study is to estimate market share or price sensitivity, a limited number of attributes need to be tested and the sample population is known to be homogeneous with respect to all product attributes.

III. Self-Explicated

Conjoint and discrete choice both determines respondent's utilities indirectly. Self-explicated determines respondents' utilities directly. With self-explicated scales, respondents are asked directly how important all levels of all attributes are to their purchase interest. Despite its conceptual simplicity, self-explicated models have been shown to be comparable to conjoint models. Self-explicated conjoint analysis requires respondents to reveal their utilities directly. Accordingly, standard questionnaire methods can be used to collect the information.

The technique involves the following steps:

- Respondent are informed about all the attributes and their levels, and the respondents are then asked to identify attribute levels that are totally unacceptable to them
- From among the acceptable levels of the attributes, respondents are asked to indicate which are the most preferred and least preferred levels of each attribute
- Using the respondents' most important attribute as an anchor, elicit importance ratings for the other attributes (on a 0 – 100 scale)
- For each attribute, rate the desirability of the different acceptable levels with the attribute

- Utilities for acceptable attribute levels are obtained by multiplying the importance rating and the desirability ratings

The utilities are then entered into a choice simulator program, and choice information similar to other conjoint programs can be obtained.

Self-explicated approaches are useful when there are a large number of attributes and the decision process being modeled is cognitive.

IV. Hybrid

Hybrid models are models that use a combination of the above techniques. The most famous hybrid model is ACA, Adaptive Conjoint Analysis.

Adaptive Conjoint Analysis

In this procedure, a computer program prompts the interviewer with questions. The procedure is as follows:

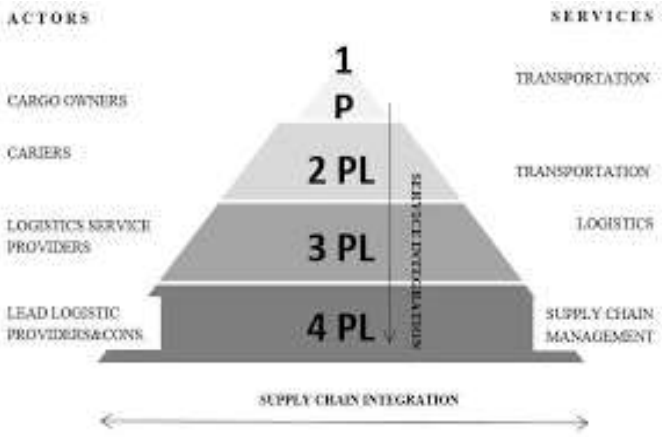
Respondents are first walked through a battery of feature-importance ratings and rankings; second, through a series of pairwise trade-offs of different product configurations. The product configurations shown to any one respondent may not include all of the attributes being tested.

The configurations to be paired are based on the answers to the importance questions and rankings asked in the beginning of the interview. Items that are considered of little importance show up in the comparisons less often. Items that are considered of greater importance show up in the comparisons more often.

For each pair of products being tested, the respondent is to indicate which product they prefer and the degree to which they prefer it. The software continues prompting with pairwise comparisons of product configurations until enough data has been collected to estimate conjoint utilities for each level of each feature. Since the procedure is adaptive, only fractions of the total number of possible product combinations are tested. ACA is an approach that is appropriate for building preference models of cognitive behavior with large numbers of attributes. It may not be as useful when price sensitivity, non- cognitive purchase decisions or interaction terms are to be modeled.

LOGISTICS OUTSOURCING:

Outsourcing is the business practice of hiring a party outside a company to perform services and create goods that traditionally were performed in-house by the company's own employees and staff. Outsourcing is a practice usually undertaken by companies as a cost-cutting measure.



- **1PL - First-Party Logistics**

An enterprise that sends goods or products from one location to another is a 1PL. For example, a local farm that transports eggs directly to a grocery store for sale is a 1PL.

- **2PL - Second-Party Logistics**

An enterprise that owns assets such as vehicles or planes to transport products from one location to another is a 2PL. That same local farm might hire a 2PL to transport their eggs from the farm to the grocery store.

- **3PL - Third-Party Logistics**

In a 3PL model, an enterprise maintains management oversight, but outsources operations of transportation and logistics to a provider who may subcontract out some or all of the execution. Additional services may be performed such as crating, boxing and packaging to add value to the supply chain. In our farm-to-grocery store example, a 3PL may be responsible for packing the eggs in cartons in addition to moving the eggs from the farm to the grocery store.

- **4PL - Fourth-Party Logistics**

In a 4PL model, an enterprise outsources management of logistics activities as well as the execution across the supply chain. The 4PL provider typically offers more strategic insight and management over the enterprise's supply chain. A manufacturer will use a 4PL to

essentially outsource its entire logistics operations. In this case, the 4PL may manage the communication with the farmer to produce more eggs as the grocery store's inventory decreases.

- **5PL - Fifth-Party Logistics**

A 5PL provider supplies innovative logistics solutions and develops an optimum supply chain network. 5PL providers seek to gain efficiencies and increased value from the beginning of the supply chain to the end through the use of technology like block chain, robotics, automation, Bluetooth beacons and Radio Frequency Identification (RFID) devices.

Through the spectrum of logistics models from 1PL to 5PL, it's clear that more and more of the logistics function are in the hands of the provider rather than the enterprise itself. The most common models now are 3PL and 4PL and each one can help to solve supply chain challenges.

What is a Third-Party Logistics Provider?

The term "third-party logistics provider," or 3PL, has been around since the 1970s. It simply means that a third party is involved in a company's logistics operations, in addition to the shipper/receiver and the carrier.

A 3PL does not take ownership of (or title to) the products being shipped. This third party comes into play as an intermediary or manager between the other two parties. The first 3PLs were intermodal marketing companies that accepted loads from shippers and tendered them to railroads, becoming a third party in the contract between shippers and carriers, according to the Council of Supply Chain Management Professionals (CSCMP) glossary. Today, any company that offers some form of logistics services for hire is known as a 3PL. This includes facilitating the movement of parts and materials from suppliers to manufacturers, as well as finished products from manufacturers to distributors and retailers.

A 3PL may or may not have its own assets, such as trucks and warehouses. In some cases, the role of 3PL and broker overlap, but typically a broker is used to engage trucking capacity for a specific shipment. A 3PL may act as a broker or use brokers to move clients' freight.

Most 3PLs offer a bundle of integrated supply chain services, including:

- Transportation
- Warehousing
- Cross-docking
- Inventory management
- Packaging
- Freight forwarding

A 3PL can scale and customize services to meet customers' needs based on their strategic requirements to move, store, and fulfill products and materials. Companies turn to 3PLs when their supply chain becomes too complex to manage internally. For example, a company may grow through mergers and acquisitions, so a supply chain that was manageable at one time outgrows the in-house capability.

What is a Fourth-Party Logistics Provider?

A fourth-party logistics provider, or 4PL, represents a higher level of supply chain management for the customer. The 4PL gives its clients a “control tower” view of their supply chains, overseeing the mix of warehouses, shipping companies, freight forwarders and agents. The goal is to have the 4PL act as the single interface between all aspects of the supply chain and the client organization.

In some cases, a 4PL may be established as a joint venture or long-term contract between a primary client and multiple partners, often to manage logistics for specific locations or lines of business. The structure of a 4PL can vary, as there may be a 4PL component within a larger 3PL relationship. A 4PL is a form of business process outsourcing, similar to contracting out human resources or financial functions.

The Advantages and Drawbacks of Logistics Outsourcing:

The rise of on-demand delivery has forced modern-day businesses to rethink their traditional logistic operation models. Outsourcing the entire function to a trustworthy 3PL partner has become a viable option since it reduces the complexity of achieving deliveries until the last mile. The benefits of logistics outsourcing come in several forms – savings in operating costs, savings in human capital, streamlined operations, no lock-in of working capital and well-connected global delivery endpoints to name a few.

Let’s take a closer look at some of the additional advantages:

1. **Reduces burden of back-office management**

On the surface, the logistic function appears to be simple: sending physical packages from point A to point B. However, before each consignment is sent out on transit, there is paperwork, auditing and verification to be conducted and documented. 3PL outsourcing service providers will have the necessary backend personnel and systems in place to take care of these procedures. From assigning a dispatch note and carrying out physical verification, to ensuring that all shipping papers are in order, logistics outsourcing can take care of the routine activities, sparing time for the business to focus on other priorities.

2. **Economies of scale**

3PL players usually have a globally distributed network of carriers and fleets which allow them to reach any destination with ease. Since the function is outsourced, it is easy to scale up or scale down the logistic reach of the business without having to set up owned infrastructure and personnel.

3. **Real-time visibility of inventory**

Professional logistic outsourcing service providers use ERP systems or cloud-based Warehouse Management Systems to help track inventory on a real-time basis. This data can also be received from the service provider on a regular basis for supply chain management planning.

4. **Expert documentation handling**

Logistics, especially cross-border logistics, requires adherence to sophisticated paperwork. For a business that has logistics only as a small function or department, this can be a tedious job to do on a routine basis. Logistics outsourcing service providers have the domain expertise and knowledge to take care of all kinds of paperwork involved like inter-connected carrier contracts, insurance certificates, bill of lading, certificate of origin, etc.

Five Often Overlooked Pitfalls in Logistic Outsourcing:

While logistic outsourcing delivers high on economic benefits, it also riddled with pitfalls that businesses must safeguard against.

1. **Outsourcing without proper appraisal process:**

A good logistics partner is hard to find. The appraisal process itself will include gathering quotes and doing quality reports to check if the provider meets benchmark standards and so on. Rushing through the tender process without adhering to a well-thought process will lead to hassles in the future.

2. **Choosing a low-pricing vendor for cost-benefit:**

An after effect of rushing through the logistic outsourcing vendor process is that you end up signing the deal with someone who offers the lowest rates. As Sun Tzu, the legendary military leader once said, "The line between disorder and order lies in logistics." Outsourcing the function to a low-priced vendor who cuts corners might actually create chaos rather than an orderly logistics function. There is a reason why top-notch 3PL players charge a premium rate. It costs a lot to have personnel and processes in place to ensure perfect paperwork, timely coordination of carriers, warehouse management and much more.

3. **Not specifying roles and responsibilities in writing:**

Logistics is a subset of supply chain management which by itself is a combination of several micro-steps. This increases the complexity in logistics planning and implementation. Unless the roles, responsibilities and tasks of each party take the form of an explicitly written a Service Level Agreement (SLA), there could be serious complications when the process kicks into action.

4. **Not viewing logistics outsourcing as a strategy:**

Logistics plays a key role in the overall strategy of an organization. Moreover, the business environment and customer demands are not what they used to be a few years ago. E-commerce, mobility, on-demand services and other advancements, have reformed the commerce landscape. If you are outsourcing logistics merely as a function to be done with, and not as a strategic element, then the business is not going to gain much despite the economy of scale.

5. **Disconnect between clients and outsourcing agents:**

Does your logistic outsourcing agent really know what you are trying to do? A lack of consensus between the parties can lead to a waste of resources and also lead to cost overruns and delayed deliveries.

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SCHOOL OF MANAGEMENT STUDIES

UNIT – III – Logistics Management – SBAA7025

III. INTEGRATED LOGISTICS

Warehousing - A logistical Challenge - Material Handling System - Role of Material handling in logistics, Material Handling guidelines, Material handling equipment's- Material Storage -Principles, Design, Methods - Reverse Logistics – Green Logistics.

WAREHOUSING: CONCEPT

A warehouse is a place used to store inventory. Most tasks that occur in a warehouse are related to inventory management. These tasks include collecting receipt of products, issuing of products, recording changes and tracking the movement of the inventory. At times, the role of a warehouse includes processing of the inventory from entry to exit, and, at times, it is limited to providing storage facility for products in transit from the point of origin to the point of destination.

Nowadays, warehouse management has an important role in effective customer service. Warehousing can play a pivotal role in minimizing supply chain inefficiencies, improving the value addition during the logistical flow of products and inventory management that includes consolidation and customization of inventory.

Before the goods are shipped to the point of consumption, a warehouse serves a place where the goods can be stocked temporarily. A warehouse is an important cog in the supply chain of products as it forms a crucial part of the chain. If a warehouse is eliminated from the supply chain, the entire logistics industry would come to a standstill. The smooth supply of goods is only possible because of warehouses. They form the spine of the supply chain. The size of the warehouses varies depending upon the number and nature of goods.

Warehousing Elements:

Whether the purpose is strictly storage or storage plus order fulfillment, warehouses use specific elements that help manufacturers, distributors, and retailers monitor inventory and store it safely. An overview of basic elements includes:

- Shelving and rack systems that offer maximum storage capacity and easy product access.

- A climate control system for the product being stored. This is particularly important for frozen products or those requiring refrigeration, including certain pharmaceutical or laboratory products, and others that degrade if exposed to too much heat.
- Inventory control software that tells the product owner – who isn't necessarily the building owner – where all individual units are in the system at all times.
- Equipment that can move products from point A to point B – forklifts, pallet jacks, bins that hold products for orders, and conveyor belts, for example.
- Shipping supplies for order fulfillment.
- People who load products into a warehouse and others ("pickers") who fill orders in a true distribution centre, plus those who manage the facility and operation.
- Security to protect stored products.
- Access to cost-effective transportation to bring products in or move them out as orders are fulfilled. That often means easy access to interstates, rail lines, or airports.

WAREHOUSE MANAGEMENT SYSTEM:

Warehouse Management System (WMS) is the cornerstone of the logistics system. A WMS constitutes an internal system of the logistics companies, which is highly configurable to control and manage aspects of storage, distribution, others. A robust WMS is what an organization needs for an efficient and productive operation, which includes inventory balance, manage materials, pickup process and auditing.

Importance of WMS:

Warehouse management process is important to meet the most primary business objective, which is to keep the operations cost low as possible and maximize the profit margin.

1. Inventory Control and Management: The common challenge of most businesses is to maintain the accuracy of the inventory. An effective WMS will help to manage the inventory in a fast, easy, and efficient way. It can improve the accuracy of the inventory by decreasing the order cycle time and improve the order fulfillment. WMS will help to decrease the inventory level by tracking every aspect of the inventory using real-time information. It will also serve all clients as WMS facilitates quick response to customers' demands and queries.

2. Centralized Location: A warehouse management system saves huge time and cost by getting a centralized storage location. Storage, shipping and distribution are much easy to have a centralized location as it can overcome the production gap. It can reach the supplier also the target market. Thus all can have a continuous flow of goods in and out which determines the firm's logistics supply chain system. The centralized location of logistic warehousing gives the opportunity to have security stocking. It means the manufacturer can fulfil customer's orders on time and deliver the right product at the right time.

3. Improve production quality: The production quality will improve by effective inventory quality and management. The manufacturer can stay up to date with vendor, suppliers and better track the raw materials or product shelf life. Thus not monitoring the quantities but the entire production process. It is now easier to get rid of defective products and ensure a high quality finished goods. By improving the production quality, the manufacturer can also maximize the company productivity as WMS boosts speed, efficiency, and quality control.

4. Leverage seasonal growth: It takes utmost advantage of the festive and other shopping seasons to scale the operations. Since it is easy to track the entire production process with real-time information, the manufacturer can also monitor consumer behavior during peak season. The tracking system can handle client problems and deliver high-quality customer service. Warehousing and logistics ensure easy tracking of the shipment through automation and real-time information. It means that, manufacturer will have better accuracy and reduce customer complaints by creating availability of what they need. Thus leveraging the seasonal growth and boosting up operations without additional cost. It means that gaining new opportunities to hit the high sales number. By having right warehouse management systems, the manufacturer can sell faster and boost profit which means the high return of investment.

5. Risk management: Warehouse management system is important to handle the fluctuations in demand and supply and avoid losses. Handle risks with the help of real-time information on an increase or decrease in the demand of the product. Make the selling decisions considering the violent rise or fall in prices.

Materials Handling System:

Materials handling occurs whenever a material is moved may be in a manufacturing, distribution (warehouse), or office environment. Materials handling also occur during preparation for shipment, transportation may be by sea, air or land, and moving material in and out of carriers.

International Material Management Society has defined the Materials Handling as "Materials handling is an art and science involving the movements, packaging and storing of substances in any form".

Objectives of Materials Handling:

As we know that with the rise of factory system, men continued to develop handling equipment to perform jobs where human or animal muscles were insufficient in either capacity or speed. Later on it becomes important to reduce materials handling labor in order to reduce production cost. Therefore main objective of materials handling engineer is to reduce product cost the one overall goal. Materials handling equipment is not production machinery, but is auxiliary equipment that improves the flow of material which in turn reduces stoppages in production machines and thus increases their production.

Objectives of a proper materials handling system are:

1. Reduction in Cost: Reduction in total cost of production can be achieved by either reducing materials handling or by improved handling procedure or both. The objective of reduction in cost of production through improved materials handling can be achieved by:

(a) Reducing material handling labor.

(b) Material handling work should not be assigned to skilled or semi-skilled labor.

(c) Reducing indirect labor expenses on activities connected with storage, inspection, quality control, repair, tool room, shipping etc.

(d) Reducing damage of materials during handling.

(e) Better utilization of space.

(f) Reducing in process storage.

(g) Increasing productivity.

(h) Reducing expenditure on packaging and other protective devices.

(i) Decreasing inventory.

2. Increase in Capacity: Improved materials handling system results in increase of capacity by better utilization of space. Improved handling system can increase the capacity in the following ways:

(a) By better utilization of space: Racks or containers that stacks item upon each other making full use of air space should be preferred. From this point of view use of overhead cranes, conveyors, lift trucks etc., are very suitable.

(b) By reducing travel space or excessive wastage of space: For this purpose a study of flow of materials between operations should be done considering the flow paths, volume of material, timing etc. This study may help in reducing travel time and space requirements.

(c) By improving equipment utilization: This can be achieved by ensuring regular supply and distribution of material. This will reduce the idling of machine.

(d) By faster loading or unloading: This can be achieved by employing conveyor system, cranes, loaders, rail road cars, tipping trucks etc.

3. Improvement in Working Conditions:

(a) Safety aspects: Safety of men, material and associated equipment not only prevents loss of money but also enhances the moral of workers.

(b) Easy working: By using proper handling equipment heavy jobs can be handled with ease, faster speed and at a constant rate throughout the period of production. This enables high morale and lower workers turnover.

(c) Fool proof operation: Due to absence of manual handling, there are no chances of confusion resulting in placing of material at wrong location or disruption of production.

4. Improved Customer Service: Customer's service will be improved by following proper and improved materials handling system which will enable regular and timely market supply by avoiding disruption in production schedule. These are the main sources of good customer service.

Functions of Materials Handling:

The basic function of material handling-the movement of material- is as old as man, but the need of materials handling developed from the development of factory system, which started from the industrial revolution which took place in late eighteenth and early nineteenth centuries.

The industries, supermarket, offices, construction projects and the banks all are engaged in moving things. In early days man was physically handling the material, however over a period of years he has started applying mechanical principles like lever, wheel, pulley etc.

The material handling, though does not add value to a product, it generally adds significant element of cost. Material handling generally costs between 20 to 35% of the cost of the product, with certain exceptions. Earlier, it was a general belief that most of this cost is inevitable and cannot be easily avoided, but now-a-days need for reduction in materials handling costs through systems approach is being realized.

Not only cost, majority of production time is also consumed in handling materials before, during and after the manufacture. The materials handling time and cost can be reduced by proper selection, operation, maintenance and layout of these handling devices.

The materials handling problem must be studied at the time of planning of various machines and tools to be required and before the erection of factory building. Materials handling is a prime consideration in designing new plants, and existing plants can also be modify by the application of modern materials handling devices. These devices increase output, improve quality, speed up the deliveries and therefore, reduces the production cost.

Costs Included in Material Handling:

Materials handling includes following costs:

Materials handling cost = cost of handling + cost of transportation + cost of packaging + cost of space + cost of handling equipment including operation, maintenance and depreciation etc.

In any industry materials handling is of following 3 types:

1. Handling of individual part or unit by men,
2. Handling in room, department, or plant
3. Handling of materials during the entire process of production and distribution, starting from raw material source, going through the factory and distribution network to the ultimate customer and beyond, to waste disposal and recycling.

This can be shown as below:

Raw material → Supplier → Transportation → Receiving → Storing → Issue → Manufacturing or fabrication → Packaging → Shipping → Dealer or Distributors warehouse → Retailers → Customer → Disposal → Recycling.

Since materials handling is concerned with the movement of materials, every movement has following elements:

1. Picking up the load,
2. Transporting the load, and
3. Setting the load down.

Systems Concept for Materials Handling:

Systems concept for materials handling means, adopting a materials handling system from overall optimization point of view. This means that it is not necessary to buy the latest materials handling equipment, materials handling engineer must put all the elements of the system together to see whether it is profitable for the enterprise. Materials handling engineer must have basic criteria for selecting a handling system of adequate monetary pay back, if all other things are equal. Systems approach for materials handling demands that all elements of problem, its cause and effect be analysed so as to accomplish to desired objectives.

Systematic analysis should lead to solutions which satisfy the following important conditions:

1. There should not be any other problem created by the new system proposed to be implemented.
2. Amount of return on investment must justify the proposed handling system.
3. The system must take care for reasonably long period of time, and that it must permit expansion or modification without much cost and difficulty.
4. The new system must be simple to implement so that it is easily acceptable by management as well as by operators.

In short the new handling system must have technique and method which can easily fit the existing system and has least total cost of the system and meets the ultimate objective of the materials handling.

By following the systems approach, materials handling engineer must achieve the following:

1. Increase the production effectiveness by having right quantity of material, at right places at the right time, by avoiding delays and following the orderly flow of material or item. This helps in improving the productivity.
2. Minimize unnecessary labor and make the enterprise more profitable.
3. Reduce damage due to materials handling and thus saves expenditure due to scrap and rework. This can be achieved only if we have sufficient data related to the damages e.g.,

identification of product or item, whether in transportation, storing, picking or setting down, packaging material or method, type of container etc.

4. Reduce accident rates.

5. Effective utilization of space by proper layout planning.

Steps in Analysing Materials Handling Problems:

Following factors should be studied to analyze the materials handling problems:

1. Establish the scope of the study.

2. Pinpoint the areas of plant layout to be covered by the study.

3. Determine volume expected to be handled per unit time by the new system.

4. Nature and type of the materials to be handled.

5. Determine the handling cost of the items being handled by the present system.

6. Determine details of distance to be moved, with details of curves, slopes etc.

7. Determine, how to move the material i.e., in tray, bundles, pallets etc.

8. Determine the details of the equipment used viz., capacity, speed, flexibility etc.

9. Determine the time taken for the movement.

10. A thorough survey should then be made considering the systems approach.

11. Alternative systems should then be evaluated from all angles including financial, physical, safety, acceptance by the management and operators, and its effects on working, safety and overall environment.

Activity Areas of Materials Handling:

For effective materials handling, materials handling engineer must look after handling work in different areas, some of them are:

1. Packaging and packing of raw material for the industry.

2. Loading and transportation to the plant.

3. Unloading activities.

4. Receiving, storage and issue of material for production.

5. In-process handling.

6. In-process storage.

7. Work-place handling.

8. Infra-departmental handling.

9. Inter-departmental handling.

10. Intra plant handling.

11. Packaging.
12. Warehousing.
13. Packing.
14. Loading and transportation to customers/distributors/dealers place.

Relationship of Materials Handling with Other Departments:

In the past materials handling was neglected and due importance was not given to this function in the industries. This was simply due to lack of awareness on the part of management. But now a day this aspect is being given its due importance and materials handling engineers play a vital role in the industries. In order to carry out the functions of materials handling, the personnel of this department work in close association with other departments of the enterprise, such as with the following:

1. Purchasing Department: To facilitate in deciding the size of order, packaging, packing and transportation system from suppliers place to the plant.

2. Stores Department: Handling and storage of materials and supplies is determined by the characteristics of the items and the nature of storage methods.

3. Production Control Department: Handling department must cooperate with production control department in following fields:

(a) Directing path of material movement.

(b) Moving material in lots or containers of predetermined sizes.

(c) Making optimum use of mechanical handling in picking, accumulation and loading.

(d) Meeting production requirement with the handling equipment.

(e) Materials handling system itself must incorporate features of production control, inventory control and accounting.

(f) Moving materials as per schedule and to avoid rush deliveries, partial loads or duplicate moves.

4. Industrial Engineering Department: Since materials handling function is a division of the broad field of industrial engineering, materials handling engineer has to work in close cooperation with other industrial engineers dealing different functions, e.g.;

(a) With the process engineering in designing the manufacturing process to establish line balancing, in-process handling, and storage operations.

(b) With the methods engineering in designing the individual work places, the methods used in performing the operations.

(c) With the work standards personnel in establishing work standards for materials handling operations for using as the basis of incentive schemes for material handlers.
(d) With plant layout personnel in developing the overall flow pattern and the arrangement of the facilities in the plant.

Relation between Plant Layout and Materials Handling:

There exists a very close relation between plant layout and materials handling. The method of handling materials definitely influences the plant layout and the plant building. If all the devices required for a particular set of operations are determined but fail to arrange them properly then it is said that layout is not a good one. Effective layout means minimum handling operations.

In the plant:

(i) If materials are to be moved by hand operated or power trucks, passages are provided for their operation.

(ii) If materials are to be moved by overhead cranes, passages are almost missing but the overhead space is unobstructed.

(iii) If materials are to be moved by pipe lines, ducts such as paint in automobile body building plants and saw dust as in wood working plants, arrangement should be made for their methods of handling.

(iv) If the building is multi-storied, elevators, and conveyors of different types may be utilized. Gravity conveyor may be utilized in moving material in a multi-storied building or one built on a sloping grade.

Modern materials handling technique makes possible a continuous flow of materials and work in process between building and from one floor to another, thus removing restrictions of space and building construction, which was handicapped in the past. Today in advanced plants handling devices operated by electronic controls are used.

Position of Plant Layout and Materials Handling Departments in an Organisation:

Position of plant layout department and materials handling department vary from organisation to organisation and depends upon its size and type of product manufactured.

The functions of these departments are generally assigned to:

1. Plant engineer/manager
2. Plan layout engineer/manager
3. Industrial engineer/manager

4. Production engineer/manager
5. Process engineer
6. Materials handling engineer.

It has generally been observed that most of the organizations assigned the job of plant layout and materials handling to either 'Plant Engineering' departments or 'Industrial Engineering' along with other functions as illustrated hereunder:

1. Plant Engineering:
(a) Plant construction,
(b) Housekeeping,
(c) Repair and maintenance,
(d) Safety and security,
(e) Facility design, and
(f) Utilities.

2. Industrial Engineering:
(a) Cost and economy studies,
(b) Work-study,
(c) Operation research,
(d) Systems engineering, and
(e) Facilities designing.

Basic Materials Handling Systems:

1. Equipment Oriented Systems:

(a) Industrial Truck Systems: Platform trucks and skids, fork trucks and pallets, and tractor-trailers.
(b) Conveyor systems.
(c) Overhead systems: Overhead cranes, and monorails.

2. Material (Load) Oriented Systems:

(a) Unit handling system.
(b) Bulk handling systems: conveyors, power shovels, scoops, cranes, draglines, and construction equipment.
(c) Liquid material handling systems.

3. Method (Production) Oriented Systems:

These are described in terms of the types of production in which they are used:

(a) Manual system.

(b) Mechanized or automated systems,

(c) Mass production handling systems.

(d) Job shop handling systems.

4. Function Oriented Handling Systems:

(a) Transportation systems: For horizontal motion.

(b) Elevating systems: For vertical motion over vertical or steeply inclined routes.

(c) Conveying systems: Horizontal, vertical or combined motions.

(d) Transferring systems: Horizontal, inclined or declined motions through the air.

(e) Self-loading systems: Intermittent motion with machines that pick up, move and set down, i.e., unit load systems.

Principles of Materials Handling:

Since it is not possible to acquire experience by a materials handling engineer himself on all types of problems, he has to take advantage of others' experience. On the basis of-experience gained by himself and also by others he should try to solve the handling problems.

On the basis of these experiences facts, systematic approach and other ideas, certain principles have been developed. These principles have been implemented, practiced and perfected during several years. These principles of material handling are useful in all the fields may it be engineering, office or elsewhere.

The word 'principle' can be defined as a prescribed guide to accepted procedures established through past practice and is accepted as authoritative by practitioners, and without which a system would be less effective. Therefore, when these principles of materials handling are applied by materials handling engineer, even if he is not much experienced, he can find correct solution faster.

These principles are general guides, and can be put to use by means of different activities. In the table below, principles of materials handling are given, and against each of them activities necessary for implementing the principle are indicated.

(A) Principles Related to Planning:

1. Planning Principle: All material handling activities should be planned.

(i) Material should be placed on pallet or any other support and not on the floor directly.

(ii) One container should be used throughout and avoid frequent changes.

(iii) Utilize truss capacities and ceiling heights.

(iv) Provide sufficient storage space at the work-place.

(v) Each operator must be instructed/trained to follow correct method.

(vi) Plan for scrap removal means.

(vii) Efforts are made to combine operations like inspection during productive operation.

(viii) Minimize movement of men and material.

2. Systems Principle: Handling activities be integrated and coordinated. Handling activities are receiving, storage, in-process handling, inspection, packaging, warehousing, shipping and transportation.

(i) Consider all the handling activities while giving a detailed consideration to an activity.

(ii) Material flow between work areas is planned.

(iii) Integrated activities into the handling system.

3. Simplification Principle: Reduce, combine or eliminate unnecessary movements and/or equipment.

(i) Motion Economy principles by applied.

(ii) Reduce or eliminate, long and complicated movements.

(iii) Deliver the material at correct spot in first instance.

(iv) Eliminate re-handling.

(v) Reduce variety of equipment.

4. Material Flow Principle: Material flow pattern must be determined by operation sequence and pattern of equipment arrangement.,

(i) Avoid overcrowding.

(ii) Eliminate obstacles in the flow.

(iii) Move in a direct path and avoid back tracking.

(iv) Move greatest weight and/or bulk for least distance.

(v) Minimize movements between floors,, and buildings.

(vi) Plan proper locations of sub-assemblies.

(vii) Plan related work areas close together.
(viii) Avoid traffic jams and take necessary precautions for cross traffic.

5. Gravity Principle: Utilize gravity where possible.
(i) Use slides, chutes, hoppers etc. where possible

6. Unit Size Principle: Increase size, quantity, weight of the load handled. Since larger the load, lesser will be the cost per unit handled.
(i) Handle unit loads. Unit loads described separately.
(ii) Use containers.
(iii) Containers should be standardized.
(iv) Use standardized pallets.
(v) Optimize unit loads.

7. Space Utilisation Principle: Optimum utilization of building space. As space means money.
(i) Equipment or work area may be kept in reasonably close position.
(ii) Inventory at temporary stores must not be kept too much.
(iii) Utilize height of building and use rack to permit higher stocking.
(iv) Use concept of economic order quantities and economic lot sizes.
(v) Dispose obsolete or scrap items in time.
(vi) Use handling equipment requiring minimum aisles.
(vii) Use mobile or overhead equipment.
(viii) Use collapsible containers to save space required by empty ones.

8. Safety Principle: Safe handling methods and equipment for better working conditions and to avoid unsafe conditions.,
(i) Provide adequate guards and other safety devices.
(ii) Handling equipment is kept in good operating conditions.
(iii) Highlight handling hazards, moving vehicles or danger areas.
(iv) Make arrangement for removal of undesirable fire, dust, smoke etc.
(v) Emergency switches or controls be provided.
(vi) Proper instructions and training for safe operation to the operators.
(vii) Keep floor clean.

(viii) Provide good housekeeping.

(ix) Keep aisles clear.

(x) Do not overload handling equipment or devices.

(B) Principles Related to Equipment:

9. Mechanization Principle: For increasing efficiency use mechanized handling equipment but to the desired extent only.

(i) Mechanization is useful for large quantities, long, frequent, high effort or hazardous moves.

(ii) Replace excess manual handling or where large numbers of persons are engaged on handling jobs.

(iii) Moving heavy containers.

(iv) Design containers suitable for mechanical handling.

(v) Use mechanized communication where required.

10. Flexibility Principle: Equipment's capable of handling variety of tasks be used.,

(i) Buy versatile and flexible equipment.

(ii) Buy adjustable racks.

(iii) Utilize accessories and attachments.

11. Equipment Selection Principle: Select equipment very carefully considering all aspects of materials, movements, and the method.

(i) Select versatile equipment.

(ii) Cost per unit to be handled should be compared.

(iii) Consider standardization aspects.

(iv) Equipment should be economical on long term basis.

12. Standardization Principle: Standardize equipment as well as methods.

(i) Standardize the equipment, containers and pallets.

(ii) Standardize methods.

(iii) Train employees on standardized equipment and methods.

13. Light Weight Principle: Reduce weight of equipment.

(i) Equipment should have less dead weight to pay load ratio.

(ii) Use light weight pallets, skids and containers.

14. Motion Principle: The handling equipment should be kept in motion i.e., minimum period for loading, unloading or other idleness.

(i) Reduce loading/unloading time.

(ii) Use mechanical means or other means for quick loading and unloading.

(iii) Use tractor trailers, so that tractor can be used for other work while the trailer is being loaded/unloaded.

(iv) Minimize downtime.

15. Idle-time Principle: Reduce idle and unproductive time.

(i) To avoid idle manpower, deliver material at a desired rate.

(ii) Do not use productive labor for handling.

(iii) In order to utilize manpower fully, more than one machine can also be allotted to one man.

(iv) Equipment should be fully utilized.

16. Obsolescence Principle: Obsolete methods and equipment be replaced by efficient methods and equipment.

(i) Obsolete equipment be identified and replaced by new equipment.

(ii) Beware of new technological developments and remain in constant touch through books, journals, attending, conferences etc.

17. Maintenance Principle: Preventive maintenance practices are adopted for handling equipment.

(i) Preventive maintenance is carried out to avoid breakdowns.

(ii) Carry out schedule maintenance and daily inspections and take remedial measures.

(iii) Set up regular maintenance schedule.

(iv) Train operators for proper operation and maintenance.

(v) Maintain adequate spare supplies.

Principles Related to Operation:

18. Control Principle: Control production and inventory through materials handling equipment.

(i) Provide direct mechanical paths for materials movement.

(ii) Materials be moved in lots, batches, containers of a predetermine quantity or size.
(iii) Materials handling system should have built in features of controlling production, inventory, and accounting.
(iv) Material is moved as per schedule.

19. Capacity Principle: Production capacity should be fully achieved.
(i) Ensure uniform desired rate of flow.
(ii) Equipment is operated at optimum rate.
(iii) Plan to utilize forward as well as return runs of the equipment.
(iv) Vehicles, conveyors, containers etc. should be loaded to full capacity.
(v) Utilize overhead space.
(vi) Aisles should be obstacle free and wide enough for speedy movement.
(vii) Store items not affected by weather.

20. Performance Principle: Performance of handling is measured in terms of cost per unit handled, safe working condition, and increase in production rate or reduced manpower for handling.
This is the effect of all preceding activities.

Limitations of Material Handling:
While evaluating a material handling system its disadvantages must also be considered.
Some of the disadvantages are:
1. Additional capital investment.
2. Loss of flexibility: A mechanical system is generally designed for a particular size, shape, volume and for a particular sequence of operation and hence it is difficult to change, and require additional cost for modification for likely range of changes in the product or production techniques.
3. Breakdown: Being mechanical and electrical system, the handling system may breakdown at times, and may take some time for repairs.
4. Every mechanical handling system requires timely maintenance, which means addition of skilled maintenance manpower, maintenance spares, cost of maintenance time required for servicing and arrangement during this period to continue production.

Role of logistics equipment's – Material handling devices:

Material handing is the general term for the machines and equipment used for the purpose of making cargo handling work more efficient and using fewer labor resources in cargo handling work that places a large burden on workers. These machines and equipment are called material handling devices. This section describes the material handling devices used at logistics worksites by the work they perform.

Equipment Used in Logistics: Material Handling Devices

There is a large amount of heavy labor involved at logistics worksites, such as in loading, unloading, and transporting cargo. Material handling device is a general term for the machines used to make this logistics work more efficient. These machines perform a variety tasks including moving raw materials, works in process, and completed products. There are many material handling devices used at logistics worksites. These include forklifts, carts, pallets, conveyors, conveyance robots, sorters, picking systems, and automated warehouses.

GUIDELINES ON MATERIAL HANDLING:

The foundation for a safe workplace starts with policies and procedures that senior management must put in place. A comprehensive health and safety policy would include the appropriate level of guidelines on material handling and the associated employee training program. A key portion of the policy would be the safety compliance activity that is essential for the business to operate. Most importantly, the policy would inform on the shared responsibilities of each employee in keeping the workplace safe.

Safety Training for Materials Handling:

There is employee safety risks involved with materials handling in distribution centers, warehouses, and shop floors and loading docks. The mitigation of safety risks starts with proper training in awareness, procedures and safety equipment. Safety training should be mandated for any new employees involved with lifting, carrying, loading or transporting materials in any form. In addition to new hire training, the safety risks and potential safety compliance rules may require re-certification on an annual or other regular time cycle.

Materials Handling Safety Procedures:

The day to day handing of materials continues free of accident or injury when safety procedures are consistently followed. Procedures start with awareness of the specific materials handling risks involved and the proper safety equipment for the situation. Procedures would cover the types of material, and the conditions of the work area.

Here's a list for safely lifting and moving materials:

- Maintain the correct posture: avoid bending over and keep lifts close to the body
- Lift in a careful, deliberate manner and avoid any sudden lift movements
- Never lift materials from a sitting position, or twist to pick up a heavy object
- Use the correct grip on objects; lifts should be shoulder high and with full grasp of the hands
- Get assistance from co-workers to avoid successive lifts of heavy objects
- Always make use of conveyors, slides or other devices, to avoid unnecessary lifting or pushing of objects
- Always go around a blocked pathway, never step over an obstacle while carrying material
- Maintain a clear line of site; objects should not block vision; lift only where there is sufficient lighting
- Whenever possible; reduce load sizes, adjust bulky objects to ease movement
- Regularly stretch back and leg muscles during the day and keep in good physical shape

Benefits of Material Handling Systems: The latest developments in material handling systems support the needs of various companies that require handling equipment. With the complex material handling processes, it is truly a great advantage to have a feasible material handling system that adapts to the unique needs of operators and industrial companies. The following are the helpful benefits of using material carts and trains in transporting containers or unit loads from the warehouse to the building site:

- save money
- increase safety

- reduce downtime
- improve ergonomics
- increase efficiency
- reduce fork transport traffic
- increase capacity
- save space
- increase flexibility
- improve the work environment

What is material handling and storage?

Material handling is the movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal. The material storage system allows materials to be stocked for a specified period of time, before they are re-introduced, or are introduced for the first time, into the automation system. Each of these material types is typically stored under different conditions and controls.

Storage is defined as 'the marketing function that involves holding goods between the time of their production and their final sale.' It bridges the gap between the time when goods are produced and the time when these are ultimately consumed as there is always a time gap between production and consumption. Storage involves making of proper arrangement for retaining goods in perfect state without losing properties and qualities till these are needed by the ultimate consumer and taken to the market. It creates both time and place utilities. "If transportation and communication define the length and breadth of the market area, then storage and its accompanying function of finance give depth to the market." In simple words, storage is the process of preserving goods from the time they are produced till they are needed for consumption.

Functions, Benefits and Importance of Storage:

The importance of storage can be recognized with the various benefits/functions it provides:

1. Creation of Time Utility: There are products which are produced continuously throughout the year while consumption is seasonal. Storage enables goods to be made available to buyers whenever they are in demand.

2. Creation of Place Utility: Another function of storage is to make goods available to a buyer at his place of business when he needs them. It creates place utility by warehouse location, e.g., a retailer can obtain goods within a few hours or minutes by contacting the wholesaler's storage.

3. Finance Function: Storage helps to obtain or raise loans by providing collateral security of the goods stored.

4. Creation of Form Utility: Certain commodities improve in quality or desirability while in storage, e.g., curing of tobacco, liquor etc. Thus, storage created form utility in certain goods.

5. Stabilizing Prices: Another function of storage is to stabilize prices by making the goods available in the market whenever there is demand.

6. Regular Production: Storage performs the function of smoothing out irregularities in production. In the present age of competition, every manufacturer tries to produce in anticipation of demand so as to provide free supply in the market well in time.

7. Ability to Face Natural Calamities: Storage enables the society to face natural calamities such as floods, famine, drought etc. In such emergencies, commodities can be made available from the storage.

8. Reduction of Risk: Storage reduces the risk of owner of goods as the owner of goods can store merchandise with reputed warehouses which absorb a part of the risk.

9. Saving in Transportation Costs: Storage allows accumulation of stocks to be transported in bulk quantities so as to reduce the transportation costs.

10. Economies of Large-Scale: Storage enables a concern to achieve the economies of large-scale production, large-scale buying and selling, etc. as the goods may be kept in stores.

Need for storage: The need for storage arises mainly because of the time gap between production and consumption of goods.

The need for storage is highlighted by the following reasons:

1. In the present competitive world, production is carried on in anticipation of demand and not necessarily for immediate sale. Thus, the producer has to make sufficient arrangements for the storage of goods.
2. Many commodities are consumed regularly throughout the year while their production has seasonal character. Such commodities have to be kept in storage in the season when they are available in plenty to be used or sold on demand.
3. Some commodities have regular production but seasonal consumption. Such commodities also need storage for the period when there is no demand.

4. Certain commodities have to be stored to improve their quality such as curing of tobacco, liquor etc.
5. Raw materials have to be stored to enable continuous production without stoppage.
6. Storage of goods is a necessity during depression when there is little demand and prices are going down.
7. Middlemen have to keep stock of goods to enable them earn profits by storage of goods and making the goods available on demand.
8. Storage is needed to adjust demand and supply of goods in the market.

What is reverse logistics?

Reverse logistics is defined as the practices and processes set up for organizing product returns from points-of-sales to the manufacturer in order to repair, recycle or dispose of these articles in the most cost-effective way. It is "the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal. More precisely, reverse logistics is the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal.

When a manufacturer's product normally moves through the supply chain network, it is to reach the distributor or customer. Any process or management after the sale of the product involves reverse logistics. If the product is defective, the customer would return the product. The manufacturing firm would then have to organize shipping of the defective product, testing the product, dismantling, repairing, recycling or disposing the product. The product would travel in reverse through the supply chain network in order to retain any use from the defective product. The logistics for such matters is reverse logistics.

Why are products returned?

Returns happen for a variety of reasons, which include:

- The customer is unhappy with the product because it is not what they were looking for or what they expected.
- The product is faulty or defective.
- The item is obsolete and has outlived its serviceability.

- Overstock that must be returned to the warehouse installation. This stock is vital for the running of a business, although they are just used in specific occasions.
- Seasonal stock, in other words, products that are only sold during certain time periods (like seasonal wear or toys during Christmas) and that must be stored the rest of the year.

Returns entail shipping and received goods must be sorted according to their SKU and condition. This has repercussions on staffing hours, the extra space needed to do this work and means higher associated costs.

Eco-friendly reverse logistics:

There is a close connection between reverse logistics and environmental protection. It focuses on managing the products, components and materials that have been used and discarded and of which the manufacturer bears some sort of responsibility. Its objective is to reuse these products and, where possible, reduce the final amount of waste.

Working with scrapped products stops fresh raw materials from having to be used to manufacture new items. This results in a direct reduction of manufacturing overhead, as well as less power usage and lower levels of air and water contamination. For reverse logistics to be as efficient as possible, it is also fundamental to involve the consumer. Businesses are responsible for being part of this process, for example, by creating campaigns that promote and encourage the active role of the people in a community in recycling.

Benefits of reverse logistics:

Setting up reverse logistics provides companies with the following advantages:

- Minimize the environmental impact. Reuse of materials in manufacturing processes helps stave off the misuse of unprocessed raw materials and requires less power. This practice will directly benefit society as a whole.
- Improve corporate image and customer satisfaction. There are significant competitive benefits for businesses using reverse logistics. More and more customers are interested in doing business with companies who are committed to environmental issues.

- Discover new ways of reworking materials. Recouping the monetary value of items that were rejected can open up new business opportunities. Outlets are a prime example, specializing in selling last season's products or those with small flaws at a lower than usual prices.
- Stock control. Reverse logistics means better stock organisation, which stops the housing of obsolete products and minimizes possible errors.
- All these advantages have a positive effect, likewise, on cutting costs and boosting revenue.

Reverse logistics is becoming more relevant throughout the business world. Even though these practices contribute to a cleaner environment, they are also a clear business opportunity thanks to savings from salvaged products. In any case, companies should put together an in-depth study of their needs and objectives to find a returns management solution that works for them.

Green Logistics: Eco-logistics or green logistics refers to the set of sustainable policies and measures aimed at reducing the environmental impact caused by the activities of this business area. This logistics concept affects the configuration of processes, structures and systems or equipment in the transport, distribution and storage of goods.

The traditional approach to logistics often leaves environmental sustainability on the sidelines during decision-making. On the other hand, the aim of green logistics is to find a balance between ecology and economy. How can you manage it? Why include green logistics policies in your company? What challenges does this particular logistics paradigm face? Here we analyze the main issues related to sustainable logistics.

The objectives of green logistics:

Green logistics seeks to:

- Measure the carbon footprint of logistics operations to establish a starting point for considering sustainability measures and controlling their results. One of the most widespread methodologies for calculating energy consumption and greenhouse gas emissions is the UNE-EN 16258:2013 international standard.

- Reduce air, soil, water and noise pollution by analysing the impact of each logistics area, especially those related to transport.
- Use supplies rationally by reusing containers and recycling packaging.
- Spreading sustainability to the supply chain, eco-logistics is also shaped by the design of products and their packaging. Both must be designed to minimize their environmental impact.

What are the challenges facing green logistics today?

Today, the logistics industry is not known for its high degree of sustainability. Companies face significant obstacles in implementing environmental policies in the field of logistics. This is due to several causes:

1. Dependence on fossil fuels, especially in transport: Effective, economically viable solutions have yet to be found to wean the sector's fuel reliance in goods transport.

2. Last Mile Deliveries' impact on urban traffic: In particular, e-commerce deliveries have greatly increased the volume of delivery vehicles in large cities and many operate without carrying full loads when faced with mixed orders.

3. Lack of infrastructure: Local authorities are in the process of regulating emission limits. However, a cross-sectoral agreement is needed to put measures in place to build new facilities that meet the wants of those involved in logistics activities.

4. Businesses which need to invest: Whether logistics operations are carried out in-house or outsourced, the tight rates and margins involved don't always let you think about investing in infrastructure, process automation or more efficient handling equipment.

5. The invisibility of logistics to consumers: Generally, logistics isn't sustainable because neither is the customer. An additional problem exists: for the customer, logistics is invisible and increasingly so. It is difficult to apply green logistics policies when the customer demands, for example, 24-hour deliveries that prevent consolidating your loads or making the most of transport flows. Moreover, logistical costs are often not itemized in an invoice or are negligible. This diminishes their relevance and, therefore, reduces the reasons for a business to invest in its environmental sustainability.

How to apply eco-friendly logistics approaches strategies:

1. Include eco-friendly criteria in your procurement policies: Sustainability criteria can be included in a company's purchasing and procurement policy when it comes to assessing suppliers' proposals. These can refer to:

- Product characteristics: e.g., buying eco-friendly packaging and limiting the use of plastic in packaging.
- Manufacturing processes: international regulations guarantee favourable environmental management. Mecalux is ISO 14001 certified, which ensures that an environmental management system has been implemented in the company's global operations.
- The supplier's location, prioritizing those closest to its facility.

In this way, the possibility of purchasing eco-friendly supplies could be evaluated. For example, more and more efficient industrial vehicle options curtail greenhouse gas emissions, especially in the light duty class. Moreover, it is worth looking into whether funding or a subsidy is available to help purchase them.

2. Optimize transport fleet management: Transport is a major carbon footprint area in the logistics chain. Aside from buying cleaner running vehicles, to limit emissions, it is necessary to use systems that assist delivery route planning and prioritize load pooling. Not only do you achieve higher efficiency in fleet management, but you also cut back the overall emissions produced by the transport.

3. Have a warehouse that follows sustainable construction and management standards: The boom in the logistics sector is driving demand for new warehouses or forcing companies to redesign their infrastructure to meet market requirements. As such, there are different ways in which eco-logistics can be reflected in warehouse design:

- The so-called 4.0 logistics buildings take centre stage: their design and construction incorporate environmental protection measures that guarantee sustainable management of the building. The Bream or Leed certifications are two of the seals that endorse logistics warehouse sustainability. These certifications are granted by analysing issues such as the water and energy consumption efficiency, the use of

alternative energy sources, the selection of construction materials and waste management throughout the entire process.

- In-warehouse monitoring and promotion of energy savings: these can be implemented in different ways. For example, the total automation of certain processes in the warehouse makes it possible to limit artificial lighting needs (emulating the methodology known as lights-out manufacturing). Another way to adhere to sustainable logistics approaches is to use as little packaging as possible on products to limit resource wastage, or to make use of adaptive packaging options which are more versatile.

4. Enable measures to reduce and recycle the waste produced in warehouse: One of the measures to help apply environmental logistics in a warehouse is to use sustainable criteria to manage the generated waste. For example:

- Establish a waste sorting process according to materials to be recycled.
- Roll back in-warehouse paper usage by implementing IT solutions such as the Easy WMS warehouse management software.
- Control special waste management so that they comply with appropriate recycling procedures.

5. Improve stock management and reverse logistics processes: Achieving a more efficient storage facility follows one of eco-logistics core principles: reducing waste through overall process improvement. Some measures to achieve this are:

- Scale down movements within your warehouse through a combination of good storage location management and optimized picking plans.
- Prevent stock damage caused by manual handling of goods. Deploying robots and automated systems in your warehouse resolves this issue.
- In the case of perishable goods, accurately manage the FIFO criterion to control expirations and prevent goods from spoiling.
- Establish quality control processes for returned products that leverage reverse logistics management.

Why go green in your logistics?

There are compelling reasons why green logistics is gaining ground:

- Green logistics policies represent a strategic advantage over the competition. Not only do they revalue your brand and set it apart, but they also prepare your company for the future, which inevitably must be sustainable.
- Energy saving measures is an effective strategy for coping with rising supply costs.
- They ensure that a company is prepared to comply with environmental regulations.

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SCHOOL OF MANAGEMENT STUDIES

UNIT – IV – Logistics Management – SBAA7025

IV. LOGISTICAL PACKAGING AND TRANSPORTATION

Logistical Packaging -Objectives, Concept, Design Consideration in Packaging, Types of Packaging Material, Packaging Costs - Transportation - Objectives, Evolution of Transportation System, Transportation Infrastructure -Different Modes of Transportation - Freight Management - Factors Affecting Freight Cost - Transportation Network - Route Planning - Containerization.

PACKAGING – CONCEPT:

The **Packaging** refers to all those activities related to designing, evaluating and producing the container for a product. Simply, the box-like container, wherein the product is stored to protect it from any physical damage and at the same time attracting the customer through its appeal is called as packaging. The product might have three layers of packaging, such as, a toothpaste come in the plastic tube (primary package), then it is packed in a cardboard box (secondary package) and then finally is packed in a corrugated box (shipping or third package). Nowadays, the packaging is not limited to the protection of a product alone, but it has been used as a marketing tool for building the brand equity and boosting sales.

In today's scenario, most of the companies use packaging as an important marketing tool because of the following factors:

- **The packaging enables the self-service**; as in the case of purchases done in the supermarkets and retail mart the customers select the products on their own without any assistance from the retailers. Thus, the company must design its product package in such a way, that it is capable enough to draw customer's attention towards it.
- **It helps in increasing the consumer affluence**, which means the customers are willing to pay even more for the convenience, appearance, dependability of the better packages.
- The packages help in increasing the brand recognition among the customers. As soon as the customers see the package, they can instantly relate it to the company or brand. For example, the Brooke Bond's Taj Mahal Tea comes in the blue pack with an image of a Taj Mahal on its box; this gives an identity to the brand.
- **The innovative packaging** also helps in bringing huge profits and benefits for the firm. Here, the company gives a unique design to its product package with the intent to grab customer's attention. For example, the calcium Sandoz bottles targeted at

children and women have been designed to make them attractive to the target segment (A dog shaped bottle for kids, while a lady-shaped bottle for women).

Thus, the packaging is capable of influencing a buyer to initiate sales since the buyer comes in contact with the package first and then after with the product.

Logistical packaging – concept:

Logistical Packaging is the science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. It also refers to the process of design, evaluation, and production of packages. As explained below, the main use for packaging is protection of the goods inside, but packaging also provides us with a recognizable logo, or packaging, we instantly know what the goods are inside.

Purposes:

- **Physical Protection** - The objects enclosed in the package may require protection from, among other things, shock, vibration, compression, temperature, etc.
- **Barrier Protection** - A barrier from oxygen, water vapour, dust, etc., is often required.
- **Containment or Agglomeration** - Small objects are typically grouped together in one package for reasons of efficiency.
- **Information transmission** - Packages and labels communicate how to use, transport, recycle, or dispose of the package or product. With pharmaceutical, food, medical, and chemical products, some types of information are required by governments.
- **Marketing** - The packaging and labels can be used by marketers to encourage potential buyers to purchase the product. Package design has been an important and constantly evolving phenomenon for dozens of years.
- **Security** - Packaging can play an important role in reducing the security risks of shipment. Packages can be made with improved tamper resistance to deter tampering and also can have tamper-evident features to help indicate tampering. Convenience - Packages can have features which add convenience in distribution, handling, display, sale, opening, use, reclosing and reuse.
- **Portion Control** - Single serving or single dosage packaging has a precise amount of contents to control usage. Bulk commodities (such as salt) can be divided into packages that are a more suitable size for individual households. It is also aids the

control of inventory: selling sealed one-liter-bottles of milk, rather than having people bring their own bottles to fill themselves.

Objectives for Packaging:

Three main objectives of packaging are:

1. Protection: The basic objective of packaging for industrial goods such as components and machinery is to protect the product while in transit. But packaging for consumer goods has a broader aim.

2. Cognizability: It is not enough for packaging to protect the product. Since the product is meant for sale in final form to the ultimate customers, it must also make the particular brand recognizable and appealing to buyers. This is very important in the case of packaged foodstuffs and other frequently purchased items from supermarkets and self-service stores. Here several brands of a product are displayed next to one another on the shelves, and it is important that the color and design of a package attract the attention of the customers and thus play a major part in promotional strategy.

The packaging lends charm to the product and reinforces the brand name. If the packaging does not induce the consumer to pick the commodity's brand in this situation, then all previous promotional efforts to differentiate these brands are wasted. Thus, packaging is an aid to advertising.

3. Shortage and usage: Packaging also facilitates the storage and use of products. Thus packages may be so designed as to conduce to the ease of handling by consumers and by members of the channel of distribution.

Functions of Packaging:

A package design is supposed to attract attention and convey an easily identifiable image. It must tell consumers what the product is and why they should buy it.

In short, packaging provides:

- A containment function
- A protection-in-transit function
- A storage function
- A usage facilitation function
- A promotion function.

First, packaging protects the product on its way to the consumer. A package protects a product during shipment. Furthermore, it can prevent tampering with products notably medications and food products in the warehouse or the retail store.

Second, it provides protection after the product is purchased. Compared with bulk (that is, unpackaged) items, packaged goods generally are more-convenient, cleaner, and less susceptible to losses from evaporation, spilling, and spoilage.

Third, it becomes a part of company's trade, marketing, wholesaling and retailing programme. A product must be packaged to meet the needs of wholesaling and retailing middlemen.

Fourth, it becomes a part of a company's consumer marketing programme. Packaging helps identify a product and thus may prevent substitution of competitive products.

All these suggest that developing and designing a package is not unlike designing the product itself. The package designer must be as buyer-oriented as the product designer.

Essential Elements of Effective Packaging Design:

The average consumer may think he or she shops based on practicality and logic, but usually, that is not the case. A lot of subconscious work goes into the average consumer's choice of a product when presented with choices on a store shelf or an e-commerce page, and these choices may be made in a split second, even when people tell themselves they are "browsing".

Effective packaging design understands consumers and allows them to satisfy themselves that they are making a rational decision, while still appealing to emotion, culture, and preferences. It is a lot to ask from simple packaging design, but brands know that design can mean the difference between a successful product and one that languishes on the shelf.

Here are six essential elements of effective packaging design:

1. It must call attention to itself: Packaging design does not necessarily have to shout the loudest from the shelf, but it must stand out by communicating the very essence of the product's unique selling proposition. Shapes, colors, orientations, and textures all play a role.

Even brands that pride themselves on understated or elegant packaging designs often make those designs so that they are different from others, and may stand out because of their understated or elegant nature.

2. It must make the brand and purpose clear: Even the most generic budget brands make their product and purpose clear, or else nobody will buy them because nobody will know what they are. While the budget brand may simply state "Tomato Sauce," other brands must make that clear as a baseline for all other packaging design considerations. People will not buy a product if they do not know what it is and what it does.

3. It should awaken emotions: Emotions are closely linked to memories, and brand packaging designs that provoke emotions are more memorable than those that do not. Precisely what those emotions are may vary. Some brands may appeal to consumers' sense of nostalgia, joy, or aspiration, for example. Marketing that plucks at people's emotions is more effective than marketing that simply touts features and benefits. That is because the emotional parts of the brain are key to forming long-term memories.

4. It should strive for "Iconic Assets": Think of brand icons that are recognized the world over. Coca-Cola, Apple, and Nike are just three examples. Not every brand will achieve iconic status, but packaging design should strive for it. The more iconic a brand's design or logo, the easier it is for people to spot in newer contexts (such as new flavor offerings).

5. It should capture and call out benefits: "Clean labeling" is hot right now. It means that labels offer clear, concise information about the brand and product, including health benefits, company values, and packaging sustainability. If your packaging is biodegradable or easy to recycle, the design should say so. If your product is low-sugar, organic, or plant-based, likewise, it should say so clearly. People care about unique product attributes.

6. It should be designed for its target audience: While designing for the target audience is not always this straightforward, it is important for brands to learn to whom, exactly, their packaging designs appeal. Testing could show, for example, that a particular packaging design gives the impression of being "for women," "for older people," or "for trendsetters," and you should know this. If your packaging design does not align with your target audience, it is probably time for a refresh.

Packaging design must not only contain products adequately and safely, it must include required elements like ingredient and nutritional information, as well as barcodes and other necessary elements. At the same time, it must appeal to consumers, often amid dozens of competing items. Packaging design should never be an afterthought because it is such a crucial element of the marketing strategy. Brands that ensure their packaging fulfills all the key elements consumers expect from packaging designs gain an edge over their competitors, whether they are sold online or in physical retail stores.

Types of packaging materials:

The types of packaging materials used in the industry are extremely wide and they range from light and economical materials such as plastic films or cardboard boxes to complex reusable structures of different packaging materials, such as those used by the aeronautical industry to move parts of the aircraft before its assembly.

A classification criterion for the types of packaging is the amount of materials they are formed of:

- **Monomaterial:** Those made of a single packaging material.
- **Multimaterial:** Those formed by two or more materials.

The importance of this classification usually lies in monomaterials normally simplifying the process of packaging and recycling. Conventional materials, like the previously mentioned, are commonly used for structural purposes mainly, while more complex materials are used for special applications such as with inert gases to prevent deterioration by oxidation.

How to define the packaging solution:

Another typical property for the selection must be added to the functional criteria of the packaging; the cost of the materials and the packaging process which tend to be decisive in their choice. For example:

- According to the costs, in industries such as the bottled water industry it is common that the bulk of the cost of each unit is logistics and packaging more than the product itself.
- In technological industries, such as telephony or jewellery, it is an almost anecdotal cost.

In order to define the materials used in a particular packaging, it is necessary to take into account the needs of the product itself, for instance, containers or bottles are required for gaseous or liquid products.

Packaging solutions must be designed taking into account:

- Product dimensions.
- Transport dimensions and fragility.
- The risks that the product-packaging system will suffer during the distribution cycle: vibrations, falls, shocks, storage time, climatic conditions.

On the other hand, the properties of packaging materials may be subjected to requirements that are not strictly of the distribution cycle like the facing needs that are imposed by marketing criteria, local laws requirements, labeling or other conditions imposed on the selection of materials used for packaging because of environmental reasons. The selection of packaging solutions will be determined by the product dimensions, its transport and fragility, the risks during the distribution cycle and other facing needs.

What types of packaging materials do exist?

The classification of the different types of packaging materials can be made from several perspectives.

From a functionality point of view;

- Containment materials (bottles, carafes, drums.)
- Materials that provide stiffness (corners, corner pieces, etc.)
- Grouping materials (grouping boxes, shrink films, among others)
- Cushioning materials (airbags, EPS blocks.)
- Points of sale (SRP, exhibitors.)
- Materials with light protection (lampshade materials, etc.)
- Product life cycle extension materials (barrier materials, active packaging.)

For example, **tertiary packaging** is usually the one material solutions are applied to for shipping. It is typically both wooden and plastic pallets, with carton handles, plastic appliqués, ropes and other resources. In tertiary packaging it is common to use slings or straps to group, made of plastic or metal, as well as cases for protection against inclement weather, dust, sun or even pests.

From the material perspective;

The classification of packaging in terms of the materials used, there is a great variety. The most common materials are:

- Plastic used in baling films, blisters, containers or bottles.
- Cardboard and paper, their main task being boxes, labels, separators and elements that help increase stiffness.
- As a combination of the previously mentioned materials, there is multilayer packaging, which normally has barrier properties.
- Wood, used in grouping pallets, in structural elements or, sometimes, as a differentiating element in quality products.

New technologies for packaging solutions:

Packaging main features have been already discussed above and some of the properties new technologies are providing have been named. Future is already here and it has come to stay. Modern packaging, among many other things, provides what is called active packaging.

- They are able to provide security to trading by reducing incidents of theft.
- They can also provide information. For example, some active packaging can change their colour when the product is at the right temperature to be consumed.
- Others extend the information about the content or redirect the user to websites where they can check the information about the product.

All these new technologies mean that when it comes to talking about packaging materials, new terms must be added such as: active packaging materials, RFID packaging and materials like antennas, chips, printed circuits or luminescent materials. One of the properties of current active packaging is to reduce the appearance of bacteria in products that require hygiene. It can also extend the product life cycle by being subjected to modified atmospheres or by using substances that trap those elements that can deteriorate products. With this aim in mind, materials are used for very advanced packaging like nanomaterial's, such as silver. With the lowering of 3D printing technology, tailor-made solutions are starting to be created for reduced circulation products, mainly cushioning materials, product supports or even some packaging.

Packaging Costs – Concept:

Packaging Cost means the cost of packaging (such as tubs, lids, cases, sleeves, bands, wrappers, pallets) purchased by Ventura for use in manufacturing or shipping a Product.

Packaging and packing cause significant costs to manufacturers. Therefore, it is important to be aware of the cost factors. Personnel costs are naturally a significant cost issue, but the amount of packing personnel depends on the amount of products, orders and order lines, picking method (sorting/ need for packing) and order periodicity as well as acquisition and disposal of packaging material after use.

Selection of the best and most cost-effective way of packaging and packing is a strategic choice. Packaging can be handled as a function, for example, immediately after production or packaging can be outsourced. Packaging solutions are affected by characteristics of the product, production volumes, market areas, distribution logistics and personnel know-how. Especially, in the export companies can be justified to take care of consumer packaging only in destination country, where packaging can be easily marked with markings required by country in question.

Cost factors to be considered:

For example, if poor quality packaging is used, this can increase overall costs in terms of the percentage of products that are damaged during shipping. Other factors that can impact the cost of logistics include:

- **Transportation costs.** The cost of actually moving the product from one point to the next is the largest factor in a total supply chain cost, usually 50% of total cost. This includes, but is not limited to, costs associated directly with transportation such as fuel or shipping charges, insurance, and so on.
- **Protection of the product.** As noted above, one role of packaging is to protect the product from being damaged during shipment. Packaging that is inadequate to protect the product will create costs associated with damaged or destroyed product; on the other hand, packaging that offers more protection than is necessary will result in higher than necessary logistics costs.
- **Handling costs.** Moving packaging around, such as moving it from a railcar to a truck, contributes to the cost of shipping a product. The design and shape of packaging can add to or detract from this cost.
- **Warehousing costs.** Depending on the specifics of a particular shipment, the product may need to be stored for a time before continuing its journey. The cost to store the product can be a function of the packaging used. Packaging that provides adequate

protection from the element may enable shipments of certain types of goods to be stored outdoors or in warehouses that are not climate controlled.

- **Administrative costs.** The cost of tracking, allocating resources to shipment and handling, contacting suppliers, coordinating operations, and so on contribute to the cost of logistics.
- **Environmental costs.** Environmental factors can contribute to the overall logistics cost of a business. This can take the form of costs for the utilization of landfill resources, fuel costs, and other similar costs. These costs can be concrete identifiable in quantifiable dollar amounts or they can be more subtle, as in the overall cost to the environment of running a given operation.

Packing Technology:

Intelligent packaging is referred to a variety of implementing means as well as use. Intelligent packaging utilizes, among other things, **Nano- technology, bio-plastics, RFID applications, holograms, conductive inks and unique digital imprints**. Digital print creates content that is located on the Internet. This means that all necessary information not need to be included in the package, but some of it may be on the Internet.

Intelligent packaging may e.g. register storage temperature. Often this is necessary, for example, in order to guarantee the quality of medicines. Corrugated board is, however, still a workable material and it can also be developed to pads used in packaging. Lightweight, papers made of microfibers may rise in the future alongside corrugated board. Automation can bring significant cost savings and improve productivity, flexibility and ergonomic benefits also in packing centers. Packaging lines can be, for example, automated and binning handled with automation. Robot cells are easily modifiable, so they are suitable for different products and packaging sizes. The machines does not necessarily have to be renewed if the product changes. Robots re-programming is quite easy. Robots can be used, for example, for a number of different products packaging, labeling and lifting boxes.

Transportation - Definition:

In business, at its most basic level, transportation is simply moving products and materials from one place to another. This includes shipment of raw materials to the manufacturer and movement of finished product to the customer. Transportation also includes the movement of parts to assembly areas as they are assembled. Modes of transport include air, rail, road,

water, cable, pipeline and space. The field can be divided into infrastructure, vehicles and operations. Transportation is important since it enables trade between people, which in turn establishes civilizations.

What is a Transportation Management System?

A **transportation management system (TMS)** is a logistics platform that uses technology to help businesses plan, execute, and optimize the physical movement of goods, both incoming and outgoing, and making sure the shipment is compliant, proper documentation is available. This kind of system is often part of a larger supply chain management (SCM) system. Sometimes known as **transportation management solution** or **transportation management software**, a TMS provides visibility into day-to-day transportation operations, trade compliance information and documentation, and ensuring the timely delivery of freight and goods. Transportation management systems also streamline the shipping process and make it easier for businesses to manage and optimize their transportation operations, whether they are by land, air, or sea.

The evolution of TMS:

Up until 2010, transport was still managed manually; irrespective of whether it involved direct delivery of product to a production line, or delivery of product to build inventory levels. Although tracking systems have been in place decades, the visibility of consignments through the general haulage network has been all but non-existent. Over the past decade, the use of telematics to locate vehicles and set up geo-fences has become standard as the cost of installing such systems has fallen. However, these systems will become increasingly obsolete as the ubiquity of smart phones and other mobile devices has resulted in the development of easily accessible and cost effective applications that are able to track consignments from departure to delivery. These systems are revolutionizing the way in which vehicles are tracked and controlled, bringing with them some obvious and significant benefits: they are usually cheap to buy and operate; most people already have access to a smart phones or tablet, and they offer an unprecedented level of flexibility and mobility.

Furthermore, the running and transmission of data using mobile over the networks costs a fraction of the price that companies currently pay to track vehicles. The transmission of mobile data also facilitates the centralization of data transmitted in real time. This means that

people can see their proof of delivery (PoD) almost immediately after delivery, which also saves the costly administration process of scanning PoDs when the vehicle returns to base.

Managing data:

Implementing a TMS won't automatically reduce transport costs, as complex systems they can be difficult to implement, and unless the time and money is invested upfront then the returns will not be realized. Accurate data is also critical to the success of any system, and the process of ensuring accurate data is maintained can be the single biggest success factor.

There are two types of data required in a TMS:

1. Static or reference data which remains constant for a defined period of time e.g. transport rates, product dimensions, type of container etc.
2. Dynamic data which is changeable and flows through the system on a daily basis e.g. demand – orders and order lines.

An effective TMS will utilize the static data, assess the demand, consider how it's packed and, based on the combined information, choose the optimum method of shipping. Demand flows through to the TMS as orders are placed on the production ERP and a good TMS will dynamically figure out the optimum transport mode and routing. There are now transport apps emerging which can be used as a standalone option or part of a modular based transport system offering access to a whole range of facilities/operations in real time including:

- booking collection slots online
- live tracking of consignments
- access to interactive delivery information, uploading any changes in schedule so that live information is always available
- instant download of Proof of delivery
- instant delivery of photographs and videos of damaged products
- Geo-fencing which automatically triggers a notification when pre-set boundaries are crossed.

Using these applications, carriers and their customers can view and manage an entire delivery manifest, allowing instant access to a whole range of information previously unavailable.

Transport infrastructure:

Transport infrastructure consists of the fixed installations, including roads, railways, airways, waterways, canals and pipelines and terminals such as airports, railway stations, bus stations,

warehouses, trucking terminals, refuelling depots (including fuelling docks and fuel stations) and seaports. Safe, efficient and sustainable transport infrastructure is important for any country around the world. Funding and constructing transport infrastructure projects can be complex and risky. They are often built on challenging and sensitive environments and over unexpected geotechnical conditions.

What are the modes of transportation in logistics?

Logistics is a very diverse and complex industry. It involves many modes of transportation and ways of shipping goods. Sometimes, it may be challenging for a company to choose the right mode of transportation to reach the best result. It can be especially difficult to domestic or global shipping.

Different modes of transportation:

There are several main transportation modes in the freight shipping industry:

- Ocean
- Air
- Rail
- Road
- Intermodal and Multimodal

All of these modes are extremely important and play a significant role in the industry. However, there are many differences in terms of price, shipped commodities, transit distance, etc. While some modes may be the perfect solution to one business, at the same time may be absolutely useless to another one.

- **Ocean shipping:**

Ocean shipping is the most popular way of moving large volumes of goods overseas. Compared to air, the ocean is a much more cost-efficient option yet a rather slow one. This mode of transportation works best for shippers who need to move goods on a distance longer than 400 km. Also, it works for oversized, hazardous, liquids, and weird-shaped freight. Ocean shipping is common among large and mid-sized businesses because they need global shipping on a regular basis. The freight is stacked in containers that are later loaded onto the ships or barges.

- **Air shipping:**

Probably the fanciest shipping mode, the air is a reliable and extremely quick way to ship freight. Obviously, extraordinary speed comes at a higher price. Because of its larger cost, the air is mostly used by bigger companies but small businesses often use it too. This option is the perfect solution for retail companies and light industries. Essentially, there are specialized aircraft for hefty cargo but in general, planes are not developed for handling oversized freight of unusual shape.

- **Over-the-Road Shipping:**

Over-the-road transportation is the most popular, the most frequently used, and the most in-demand mode of transportation. It works for everyone, from individual shippers to large enterprises. Also, road transport comes with a wide variety of equipment and shipping modes. There are two main types of over-the-road transportation: full truckload (FTL) and less-than-truckload (LTL). FTL shipping means that one shipper takes the entire truck capacity to move the freight when LTL suggests partial use of the trailer by several shippers. There are also various types of trailers that serve different shipping needs: dry van, flatbed, refrigerated, etc. It is easy to get a freight quote from the carrier and choose the needed equipment.

- **Intermodal and Multimodal:**

Choosing the right mode of transportation may be difficult, especially if you have a long and complicated route. Intermodal and multimodal can transportation solves this problem, as they are two types of combination transportation modes.
Generally, intermodal and multimodal shipping suggest the combination of road, rail, ocean, or air for a single shipment. The only difference between both methods is that intermodal is handled under a single bill, while multimodal goes with separate bills from all the carriers involved. Generally, intermodal and multimodal can be very beneficial to the shipper in terms of price and flexibility. Ultimately, each mode of transportation has its advantages and drawbacks.

What is Freight Management Logistics?

Freight management logistics encompass the technology, experience, human resources and knowledge utilized to facilitate effective, efficient and expeditious coordination between carriers and shippers and ensure goods are delivered on budget, and on time. This all-important network provides the critical guidance and support so vital for the smooth operation of the ever-evolving freight forwarding industry. Freight management logistics

comprise the core mechanisms and infrastructure at the heart of this estimated $270 billion global business. Though essentially invisible to the land-based general public, international maritime shipping accounts for about 90 percent of world trade, and without such logistical precision underpinnings, would simply not be possible.

The Role of Freight Forwarders:

Overseeing these mechanics and ensuring this exactitude is a freight management logistics team dedicated to:

- Maintaining relationships with steamship lines
- Minimizing empty miles by coordinating efficient shipping routes
- Negotiating freight rate contracts
- Ensuring continued customs compliance and insurance protection

Freight forwarders manage the following logistical responsibilities:

- Communication
- Tracing and Tracking
- Warehousing and Distribution
- Customs
- Insurance

Factors that affect freight rates:

Rates for freight transportation might seem like they're calculated using some complex algorithm that makes little sense. However, there are several factors that impact the rates for LTL (less than a truckload) freight shipping. Here are 6 of those factors to help take the mystery out of freight transportation pricing:

1. Classification of freight – All LTL freight to be shipped must be assigned a freight class and appropriate NMFC codes (National Motor Freight Classification) based on the type of freight it is. Different types of freight classifications have different rates. This is why working with a knowledgeable freight broker is so important that they ensure freight shipment has the correct classification and NMFC codes.

2. Distance of shipment – Generally speaking, the farther the distance, the higher the cost. Additional costs related to distance may be added if the shipment is going to an area the transport carrier doesn't serve, and the shipment has to be transferred to a second carrier to get it to the desired destination. A good freight agent is your partner in keeping such switch-overs to a minimum.

3. Weight of freight – LTL freight weighs between 151 lbs. and 20,000 lbs. With such a large range, weight is calculated per 100 lbs. Generally, the more a shipment weighs, the lower the cost per 100 lbs. This creates a bit of a discount incentive for larger and heavier freight shipments.

4. Carrier base rate – Each carrier has their own base rate, which is calculated per 100 lbs. However, your freight broker may be able to negotiate the base rate for a particular shipment with a carrier if that carrier needs volume to create full truckloads on certain routes.

5. Absolute Minimum Charge – Every carrier has an Absolute Minimum Charge or AMC that is the lowest possible charge for that carrier. Many carriers increase their AMC over time, particularly if they have a high number of shipments at or close to the AMC because the carrier has greater costs for AMC shipments over larger, heavier shipments.

6. Added surcharges – Surcharges are added to freight rates for extra services or services beyond the standard dock-to-dock or business-to-business delivery. For example, a carrier may add surcharges for residential delivery (or pick-up), inside delivery, lift gate service, or delivery to a location with limited access, such as schools, churches, prisons and storage facilities. Additionally, fuel surcharges are typically added to every freight quote across nearly all carriers.

Transport network

The complete system of the routes pertaining to all means of transport available in a particular area, made up of the network particular to each means of transport. A transport network, or transportation network is a realization of a spatial network, describing a structure which permits either vehicular movement or flow of some commodity. Examples include but are not limited to road networks, railways, air routes, pipelines, aqueducts, and power lines.

What is Route Planning?

Route planning is about how to create driving directions or routes for multiple locations in the most efficient way. Here is a definition from the website Business Dictionary: "Computing the most cost-effective route involving several nodes or stopovers by minimizing the distance travelled and/or time taken". There are many terms to describe the process of "route planning," it can be seen with the following wordings:

- Route planning and schedule
- Route optimization
- Route management or route making

- A trip planner, planner journey, or trip planners
- Fleet management, vehicles or of several fleets
- Vehicle management or driver management

All these terms are related and all points are similar place (e.g., creating the best driving directions (or routes) to multiple locations, addresses or stops). Route optimization is a part of the route planning process because it's about optimizing the routes in terms of speed and efficiency. Routes or vehicle management could encompass a more comprehensive array of issues, including maintenance and so on.

CONTAINERIZATION – CONCEPT:

Containerization is the international shipping practice of storing a number of pieces of freight within a large container and transporting them as a single unit. This technique offers benefits to shippers, including less cargo handling, greater cargo protection and reduced shipping costs. Standardized containers, typically in 20- or 40-foot lengths, can be transported over long distances and transferred between transportation modes more efficiently.

Advantages of containerization include:

- Less handling of cargo
- More protection against pilferage
- Less exposure to elements
- Lower shipping costs

Even if containerization conveys numerous advantages to freight distribution, it does not come without challenges. **The main advantages of containerization are:**

- **Standardization.** The container is a standard transport product that can be handled anywhere in the world (ISO standard) through specialized modes (ships, trucks, barges, and wagons) and equipment. Each container has a unique identification number and a size type code.
- **Flexibility.** It can be used to carry a wide variety of goods such as commodities (coal, wheat), manufactured goods, cars, and refrigerated (perishable) goods. There are adapted containers for dry cargo, liquids (oil and chemical products), and refrigerated cargo. Discarded containers can be recycled and reused for other purposes.

- **Costs.** Lower transport costs due to the advantages of standardization. Moving the same amount of break-bulk freight in a container is about 20 times less expensive than conventional means. Containers enable economies of scale at modes and terminals that were not possible through standard break-bulk handling.
- **Velocity.** Transhipment operations are minimal and rapid, and port turnaround times have been reduced from 3 weeks to about 24 hours. Because of this transhipment advantage, transport chains involved containers are faster. Containerships are faster than regular freighter ships.
- **Warehousing.** The container is its own warehouse, protecting the cargo it contains. This implies simpler and less expensive packaging for containerized cargoes, particularly consumption goods. The stacking capacity on ships, trains (double-stacking), and on the ground (container yards) is a net advantage of containerization. With the proper equipment, a container had can increase its stacking density.
- **Security and safety.** The container contents are unknown to carriers since it can only be opened at the origin (seller/shipper), at customs, and the destination (buyer). This implies reduced spoilage and losses (theft).

The main drawbacks of containerization are:

- **Site constraints.** Containers are a large consumer of terminal space (mostly for storage), implying that many intermodal terminals have been relocated to the urban periphery. Draft issues at the port are emerging with the introduction of larger containerships, particularly those of the post-panamax class. A large post-panamax containership requires a draft of at least 13 meters.
- **Capital intensiveness.** Container handling infrastructures and equipment (giant cranes, warehousing facilities, inland road, and rail access) are important capital investments that require large pools of available capital. Further, the push towards automation is increasing the capital intensiveness of intermodal terminals.
- **Stacking.** The complexity of the arrangement of containers, both on the ground and modes (containerships and double-stack trains), requires frequent restacking, which incurs additional costs and time for terminal operators. The larger the load unit or the yard, the more complex its operational management.
- **Repositioning.** Because of trade imbalances, many containers are moved empty (20% of all flows). However, either full or empty, a container takes the same amount of

space. The observed divergence between production and consumption at the global level requires the repositioning of containerized assets over long distances (transoceanic).

- **Theft and losses.** High-value goods and a load unit that can forcefully be opened or carried away (on a truck) implied a level of cargo vulnerability between a terminal and the final destination. About 1,500 containers are lost at sea each year (fall overboard), mainly because of bad weather.

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UNIT – V – Logistics Management – SBAA7025

V. GLOBAL LOGISTICS

E-logistics - ICT and logistics - E- logistics for transport modes and nodes - ICT for airfreight management, ICT for rail freight management, ICT for road freight management, Port-centric ICT system - Automating e-logistics - RFID in logistics –Global logistics -International and global issues in logistics.

E - LOGISTICS: CONCEPT

E-Logistics is a Dynamic set of communication computing and collaborative technologies that transform key logistical processes to be customer centric by sharing data, Knowledge and information with Supply chain partners. **E-logistics** is defined to be the mechanism of automating **logistics** processes and providing an integrated, end-to-end fulfilment and supply chain management services to the players of **logistics** processes.

E-logistics helps in managing the new challenges in the supply chain field. The main components of the **e-logistics** are multi-channel operations, cross-border tasks, warehouse plan and inventory, planning, estimating and performance management.

The impact of ICT on the logistics industry:

Information and Communication Technologies (ICT) covers vast areas of technologies such as mobile and wireless technology, telecommunications, software development, security, intelligent systems etc. ICT has had a huge impact on industry, the community in general and our daily lives. ICT can be applied to many fields. One of the emerging applications in recent years is in logistics.

Logistics is a process which interfaces and interacts between companies, vendors, customers, carriers etc. and within the company itself using logistics internally. Logistics is responsible for the movement of products from the vendors through to the delivery at the customer's door, including moving through manufacturing facilities, warehouses and third-parties, such as distributors.

Since logistics plays an important role in both industry and daily life and involves many parties in the supply chain, the system needs substantial agility. This can be done by using ICT techniques that allow logistics industry to provide more efficient results, since it play an essential role in warehousing, transportation and information exchange.

Impact of Information Technology in the Field of Logistics:

- A huge advance in information technology has already taken place in all the industries including changes in the logistics and supply chain. A fast data transfer is a result of information technology in supply chain management resulting in increased cooperation.

- Information Technology helps to restructure the entire distribution set up to achieve higher service levels and lower inventory and lower supply chain costs. IT developments have presented companies with unprecedented opportunities to gain competitive advantage. So IT investment is the pre-requisite thing for each firm in order to sustain in the market.

- Supply chain management (SCM) is concerned with the flow of products and information between supply chain members' organizations. Recent development in technologies enables the organization to avail information easily in their premises.

- The development of Inter organizational information system for the supply chain has three distinct advantages like cost reduction, productivity, improvement and product/market strategies.

The different role of IT in logistics and supply chain are:

1. Electronic Commerce: Electronic commerce includes electronic data interchange, e-mail, electronic fund transfers, electronic publishing, image processing, electronic bulletin boards, shared databases and magnetic/optical data capture.

2. Electronic Data Interchange: EDI describes both the capability and practice of communicating information between two organizations electronically instead of traditional form of mail, courier, & fax. The benefits of EDI are:

- Quick process to information.

- Better customer service.
- Optimize paper work.
- Increased productivity.
- Improved tracing and expediting.
- Cost efficiency.
- Competitive advantage.
- Improved billing.

3. Bar Coding and Scanner: Bar coding is a sequence of parallel lines of different thickness with spaces in between. These bars are nothing but the items of information in the codified form, which can be read with the help of a scanner. The information printed in bar code includes country code, manufacturer name, product details, date of manufacture, material content etc. These details are required at user end for inventory management.

Bar Coding and Scanner has reduced paper work and processing time. It has increased logistics system productivity through speed, accuracy and reliability.

4. SKU DIM: This SKU (Stock Keeping Unit) DIM capturing is done by weight machine integration. During previous years this was done manually and it was time consuming. Now with the help of this DIM, length, width, height, weight of the consignment is measured without any much hassle and moreover here we can avoid revenue leakage, because in our experience we have seen users capturing wrong dimensions which lead to wrong calculation during billing.

5. RFID: RFID is an Automatic Identification and Data Capture (AIDC) technology. RFID first appeared in tracking and access applications during 1980. RFID-based systems allows for non contact reading and are effective in manufacturing and other environment where bar codes could not survive.

These are used as an alternative to Barcodes to communicate the inventory data to the reader via radio waves. RFID wirelessly exchanges information between a tagged object and a

reader. RFID has improved the ability of manufacturers to better manage the inventory levels. It has improved the tracking, logistics and planning operations.

6. Case ID Capture: This ID is used to capture information on cases, where for each SKU; box case will be defined with number of SKU units kept inside each unique product cases. In some cases information will be flown and measured towards UOM which is mentioned as CASES.

7. Route Optimization: Truck routing, delivery scheduling and fleet management software solutions help hundreds of private fleet and logistics operators to cut transportation costs every day – giving a fast return on software investment.

Some of the uses of this route optimization are:

- Reduce total mileage for lower fuel bills
- Fully utilize the fleet for maximum distribution efficiency
- Cut overtime and agency bills with improved driver productivity
- Optimize the distribution networks to reduce overall transportation costs

8. GPS Tracking (Track & Trace): New and growing logistics companies are quite apprehensive and skeptical about transport management, claiming that it will only result in increased expenses that could eventually hurt their business in the long run. This is a common misconception about GPS tracking.

The benefits of GPS Tracking system includes below:

- Real time monitoring of the shipment
- Reduced fuel consumption
- Improved productivity
- Better Customer Service

9. Last mail Delivery Tracking on Mobility: Last mail delivery plays a vital role in SCM. Now days B2C transaction is increased and every end customer expects the delivery on time. To active this, TAT service providers are very key on delivery information capture and

reflecting it in the online sites. The effects of information technology in logistics management that can be mentioned are improving cooperation relationships in internal and external dimensions, increasing responsibility, creating new relationships with customers to identify their needs, developing sales channels, improving performance and improving the competitive position of the chain. The pressure to invest in technology is high and will increase. This is because competitors will also be investing in technology to improve the effectiveness of their supply chains and develop new ways of doing business in order to achieve competitive advantage.

FIVE COMMONLY USED TRANSPORT MODES:

These most common five modes of transport are: railways, roadways, airways, waterways and pipelines.

I. Railways:

Indian railway system has grown into Asia's largest and the world's fourth largest. It has route length of 72,000 kilo meters by the end of 1990. The daily run is 15,000 kilo meters with running of 12,000 trains carrying 7 lakh tons of goods. The average cost per ton kilo meter is 27 paise.

Evaluation:

Merits:

1. Large carrying capacity: Compared to other means of transport, railways are known for bulk carriage of goods over long distances.

2. It is economical: As the freight rates are telescopic and referential, it works cheaper particularly in case of heavy goods over long distances.

3. It is all weather modes: Railways provide all season protection to the products moved on uninterrupted basis.

4. It has containerization: Indian railways have done a good job by containerizing on major routes facilitating safe, uninterrupted and speedier movement of goods.

5. It links international markets: Railways are the main sources of connections with the markets outside the country moving goods from interior parts to the points of overseas supply and shipping.

Demerits:

1. Costlier over short distances: Railway transport works costlier over short distances because of tapering and differential tariff rates.

2. Slower movement: As compared to road and air transport, the speed of movement is slower.

3. Inordinate delays: In India we have three types of lines as broad, meter and narrow gauge resulting in frequent transshipments; again shortage of wagons and, therefore, space forces the business community to tolerate inordinate delays.

II. Roadways:

Indian road network is one of the largest in the world. It has a total road length of 18 lakh kilo meters of which 50 percent is surfaced. Of this, national highways account for 35,000 kilometers account for the 50 percent of total traffic. On this road length, 9 lakh vehicles ply carrying goods.

Evaluation:

Merits:

1. Economical over short distances: As compared railways, it is more economical. The studies have proved that it is cheaper by 25 percent.

2. Speedier movement: Road transport is speedier than the railways giving point to point service resulting in price stabilization and consumer satisfaction. The business community needs not wait because of wagon shortage, transshipment because a truck has a smaller capacity and is flexible available 24 hours.

3. Touching for-flung markets: Much beyond the capacity of railways, the roadways are known for reaching impregnable market particularly hilly regions where railways cannot reach.

4. Lesser conditions of service: The roadways do not insist on strict packaging requirements because of least transshipments shocks to goods carried. Again, damage claims are settled faster.

Demerits:

1. Uneconomical over long distances: Long haulages work out much costlier because disproportionate rise in fuel and spare-parts expenses.

2. It is fair weather friend: Roadways are closed during monsoons and winters resulting in handicapped movement of goods.

3. Not suitable for bulk transport: Bulky and heavy goods to be moved particularly over longer distances need railway services than roadways as it has a major limitation of carrying capacity.

III. Airways:

We cannot boast of airways in India as we do in case of railways and roadways because, it is underdeveloped and underutilized. It acts as a feeder or supporting transport means. Domestic capacity available is 115 lakh ton kilo meters but utilized only to the extent of 12 lakh ton kilometers in 1990. International capacity corresponds to 218 lakh ton-kilo meters of which 175 lakh ton-kilo meters are used. India has 4 international airports, 92 aerodromes with 50 intermediate and 40 minor aerodromes.

Evaluation:

Merits:

1. Fastest means of transport: Air transport provides the speediest movement of cargo over the distant places by eliminating practically spatial barriers.

2. All weather friends: It is known for its dependable service during the times of floods, wars, earth-quakes. It is all weather means, of transport though flights are cancelled due to bad weather conditions.

3. Consumer satisfaction: The level of consumer service and, hence satisfaction is of high order as it is known for immediacy, speed and least damage to cargo.

4. Reduced inventory holdings: As it provides fastest and uninterrupted service, capital investments in the form of stocks of goods is less. This is of particular importance in case of highly perishable items.

Demerits:

1. It is costlier means of transport: The cost of air transport is very high and there is limit of weight of cargo. Hence, it is suitable for light weight, high grade and costly items only.

2. Limited coverage: The planes cannot land at all the places of our choice. It connects metropolis and some important cities only.

3. Limited cargo capacity: The cargo capacity of a plane is much smaller because of its size as it works against the force of gravity.

IV. Waterways:

Waterways of the nation provide other alternative means of transport. Unfortunately, in India, waterways are not fully developed though she has a great potentiality. Though India has 7,000 kilo meters of navigable river waterways, only 2,500 kilometers are used. Again, we have 4,800 kilo meters of canals of only 600 kilo meters are navigable but hardly 400 kilo meters are actually used.

Evaluation:

Merits:

1. It is cheaper means of transport: Inland waterways tariffs are much lower and, therefore it works cheaper for both short and long distances.

2. Most suitable for heavy and fragile products: The items which are bulky and heavy and which are fragile can be moved with ease.

3. Loading and unloading facilities: The sender of cargo has the facilities of loading and unloading from boats and wharves on and from steamers and barges. Even the receiver has the similar facilities.

4. No problem of congestion: Waterways provide an independent movement unlike road system where road is meant for all kinds of vehicles creating the problem of congestion.

Demerits:

1. Slow speed: The speed of the boats and steamers is badly limited in case of canals and rivers. Goods needing quick movement as perishable can be hardly transported.

2. Unreliable: Changing seasons create problems. Winter may freeze the rivers and canals and summer eats the depth of rivers and canals. Again, the rivers are known for changing their course of flow.

3. Limited service: The inland waterways are connecting the given places. Again, the cargo capacity is quite limited.

V. Pipe-Lines:

Pipe-lines are the specialized means of transportation designed to move the items like crude-oil, petroleum, chemicals, coal, lime-stone, iron-ore, copper concentrates and gas. India has made a late beginning in this regard unlike U.S.A., U.S.S.R. and Middle-East, and the development is undertaken only in case of oil refineries to move petrol and gas from sources to markets.

The total pipe length in India, at present is of the order of 8,000 kilo meters owned by private and public undertakings such as Oil India Limited, Indian Oil Corporation and Oil and Natural Gas Commission. Biggest Pipeline is planned between Iran and India.

Evaluation:

Merits:

1. Economical: Crude oil or coal and gas transported through the pipelines works out almost 1/4 of railways and roadways.

2. Uninterrupted service: Pipe-line transportation presents all weather system to move the products. Absolutely there is no any wastage of time as it works round the clock.

3. No danger of wastage: As there are no occasions of loading and unloading, there is no scope for spilling, evaporation, pilferage and so on.

4. Underground: The pipe-line usually underground and, hence, takes no additional space. What is more important is that it traverses through difficult terrain.

Demerits:

1. Initial heavy investment: Though operational and maintenance costs are minimal, the capital cost of pipe-line is rather much higher and that is why a county like India has minimum length.

2. Danger of enemy attacks: In the periods of war and political hegemony, pipe-lines are more prone to enemy attacks thus jeopardizing the veins of supply to the entire nation. The production activities are grinded to halt.

PORT CENTRIC LOGISTICS

Port Centric Logistics as a concept in supply chain management has developed since around the turn of the millennium. Multimodal transport driven container logistics operations typically utilise ocean-going vessels for long-distance movements, with inland movements undertaken by barge, rail or truck. Conventionally the container is unloaded from the ship at the port and transported to an inland destination by intermodal freight transport. In the port centric approach, the container is unloaded (or "unstuffed") at the port and its contents are then transported inland e.g. as palletised freight.

The port centric approach is not appropriate for all supply chains, but due to the complexities of modern logistics networks it can be difficult to quantify the benefits for each case. Operationally, port centric logistics offers significant benefits but also presents a number of

planning and management issues which need to be overcome. For example, increased storage of goods, and corresponding handling activity could lead to increased congestion around the port. On the other hand, the greater flexibility for distributing the goods in (e.g.) palletised form can lead to savings in the relatively costly inland transport section of the supply chain.

Main Advantages of Port-Centric Logistic Zones:

Activities related to freight distribution had historically been located directly adjacent to port terminal facilities and were having a notable spatial imprint. Containerization incited the development of new terminal facilities and a relocation of many warehousing activities into peripheral greenfield sites, leaving former warehousing and industrial land idle, abandoned and often reconverted to other uses. The outcome for many container ports was a disconnection between the port and the distribution activities it was supporting. With growing levels of congestion around several ports, this strategy is being reassessed as supply chain managers consider the advantages of port-centric logistic zones:

- **Land**. The developers of port centric logistic zones, commonly port authorities, have been able to secure a significant real estate base next to port facilities; in co-location. This often takes place with the conversion of brown field sites (e.g. abandoned industrial or warehousing facilities). As many port facilities are near central areas, recruiting labor tends to be less problematic than at peripheral sites.
- **Drayage**. Since port-centric logistic zones are adjacent to terminal facilities, trucks have a direct access to terminal gates and able to quickly retrieve and deliver containers. Since trucks do not require to go through local roads, weight restrictions are less impairing the stuffing of containers. There is thus the potential to take full advantage of the weight limits of container loads and have more freight loads being carried.
- **Container assets**. Port-centric logistic zones maximize the efficiency of transloading (e.g. transferring the contents of maritime containers into domestic containers or truckloads), which lowers dwell time. Maritime shipping companies are thus able to quickly get their empty containers back, which can then be repositioned to loading locations.
- **Supply chain management**. There are several supply chain advantages in using port-centric logistic zones. Depending on the configuration of the hinterland (most of the customers within 600 km), the distribution center is able to provide direct deliveries by truck to customers, which is associated with lower lead times and inventory levels.

THE AUTOMATION PROCESS IN THE LOGISTICS

Automation or automatic control in logistics refers to the use of control systems, machinery or software to improve the efficiency of operations. It usually applies to processes that must be performed in a warehouse or distribution center and which result in minimal human intervention.

In fact, along a supply chain (procurement, distribution, customer service, and reverse logistics) there are a multitude of processes that could be automated. For example, Stock Logistic has warehousing and distribution services**,** both for dry and refrigerated cargo, for any type of industry and whose processes are automated.

The main advantages of automation logistics are:

- **Real-time access to loading and data analysis**. When you have access to load data and the ability to run reports, you have the ability to make better business decisions.
- **Reduction of mistakes** that cause a great cost. In manual data entry there can be a number of mistakes that result in increased shipping costs.
- **Organizational control**. The systems are usually flexible enough to adapt to the company's business rules and, at the same time, powerful enough to force all users, both internal and external, to follow the policies that ensure efficient and profitable shipping.
- **Improved customer service** as you can track in real time cargo, auto pick-up, adequate insurance and cargo accounting by incorporating it into your order specifications.
- **Scalability and speed**. The software provides ease of entry into the system and manages with greater agility, for example, a **warehouse**. In addition all transport invoices can be consolidated into a single weekly invoice, no matter how many shipments you have in each location.

Logistic automation, however, also has some disadvantages:

- **Less flexibility**, both in processes and in process changes. In other words, it is doubtful whether it will be possible to standardize certain processes so that they can be executed more efficiently in an automated system.

- Taking into account the large number of **actors in a supply chain**: suppliers, manufacturers, customers, distributors. All of them can present pitfalls and be reluctant to include the necessary and obligatory technological solutions for automation.
- **Time** is another element often cited against them. An automated system can take an average of 10 years to implement, which when faced with the cost of putting it into operation, sometimes gives returns on the investment that companies consider too low.

What is RFID?

RFID stands for "radio frequency identification". It's a technology that captures digital data encoded in smart labels and RFID tags through a reader via radio waves. RFID serves a similar purpose to that of bar code or a magnetic strip of an ATM card where data from a label or tag is captured by the device and then later stored in the database.

However, RFID works better than barcode and ATM magnetic strips. The most significant advantage of using RFID over barcode is that it doesn't need to be placed or positioned relatively to the scanner.

How does it work?

RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID methods utilize radio waves to accomplish this.

At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated circuit and an antenna, which is used to transmit data to the RFID reader (also called an interrogator).

The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed later. Before diving deep into the working of RFID, let's see what the different components that it comprises are.

The major part that RFID consists of are:

1. RFID tag

2. RFID reader

1. RFID tag:

RFID tag consists of an embedded transmitter and a receiver. RFID component comprises two parts:

Integrated circuit: - It's used for storing and processing the information.

Antenna: - It's used to transmit and receive signals.

RFID tag also has a non-volatile memory storage which includes either programmable or fixed logic for sensor data and transmission.

Tags can be categorized as:

Passive: - This tag remains dormant since it has no battery. It uses reader's signal energy to turn on the tag along with reflecting a signal back to the reader that carries the information.

Active: - Active RFID tags have a battery in it that transmits signals periodically. These tags have range up to 100 meters due to the presence of a battery. Due to this, active tags are useful in location tracking applications.

Battery-assistive passive: - These tags do contain a battery but it doesn't transmit signals periodically like that of active RFID tags.

The battery is used to turn the tag when it receives a signal which enables all the energy from the reader's signal to reflect.

2. RFID reader

RFID reader consists of an interrogator which is nothing but a two-way radio transmitted-receiver also known as transceiver.

The prime function of transceiver is to transmit an encoded signal that activates the tag. In response the tag transponder initiates the conversion of radio signals into usable power along with responding to the reader.

Benefits of RFID:

- Adds flexibility and intelligence in the process to improve service levels.
- Reduces the total cycle time order until the goods delivery.
- Reduces the errors made in deliveries of customers' orders.
- Easy monitoring of all logistics operations along with increased security.
- Increased speed and agility in locating materials.
- Helps in avoiding tampering with recording of unique codes.
- Makes it easy to manage products and materials with less manpower.

Challenges in RFID implementation:

RFID is a costly affair:

RFID requires costly equipment whether it be a software or hardware. Moreover, talking about the tags is it active, passive, or semi-passive are a costly affair and has the capability to set the business backwards. The rates of RFID tags have lowered since 1970s, but still many companies are reluctant to adopt it due to its steep prices.

Trouble with metals & liquids:

RFID doesn't go well with metals and liquids as they both make it difficult to obtain proper reads on assets. In metals the radio waves bounces all over the place. Similarly, the liquid can absorb the signals from the RFID tags.

Difficult to understand the technology:

It's difficult to understand about the different tags and frequencies. Managers need to understand the technology well so that they can train their employees about its working.

RFID collision course:

Workers often come across reader and tag collisions. In reader collision, a worker faces the interferences from another reader in the field. Similarly, in tag collision, the workers face reading an abundant amount of tags at a time. It occurs when more than one tag reflects a signal that confuses the reader.

WHAT IS GLOBAL LOGISTICS?

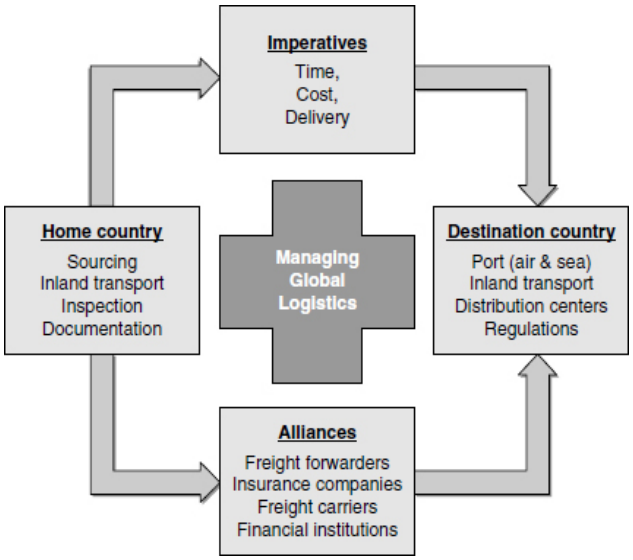
Global Logistics refers to an international commodity transaction or exchange activity that physically moves materials in order to overcome the spatial and temporal distance between production and consumption when production and consumption are independently conducted in two or more countries. The ultimate purpose of international commodity transactions is to realize the delivery and delivery of documents, and the payment of goods and goods; at the same time accept the acceptance of documents, payment of goods and trade convection conditions of goods.

International and global issues in logistics:

Here is a snapshot into 8 of the top challenges facing the industry.

1. **Fuel Costs.** One of the highest costs contributing to the 'cutting transportation cost' concern is fuel prices. Higher fuel prices are likely to increase transportation costs for US shippers this year by pushing up fuel surcharges. Rising US diesel fuel prices are escalating surcharges added to freight rates, which is reversing a two-year trend that cut into the revenue and earnings of truckers as fuel prices plummeted.
2. **Business Process Improvement.** Not withstanding the need for new technology, which we discuss in number eight on this list, it has become an increasing challenge for the logistics industry to stay on top of new advances in business processes. Taking advantage of these new opportunities sounds enticing but adoption and on boarding can be overwhelming.
3. **Improved Customer Service.** Customers want full transparency into where their delivery is at all times. These days, the location of a package is as interconnected as your social network. In fact, as customer expectations have increased, their willingness to pay for fast shipping has decreased with just about 64 percent of consumers unwilling to pay anything extra for less than two-day shipping.

4. **Economy.** With high fuel prices comes a greater credit crisis and rising inflationary demands that take a greater toll on the US economy. This industry is then pressured by increasing compliance regulations, declining demand, additional capacity with additional increases in key cost centers.
5. **Driver Shortage and Retention.** Hiring and retention remain an issue despite the lower demand mentioned above.
6. **Government Regulations.** Carriers face significant compliance regulations imposed by federal, state and local authorities.
7. **Environmental Issues.** The anti-idling and other emission reduction regulations brought about by state and local governments has created concern that the compliance costs could exceed benefits.
8. **Technology Strategy & Implementation.** While the industry understands and supports many of the benefits of these technologies, some questions remain as to how they will pay for it and who will help implement the improvements.



DIFFERENCE BETWEEN DOMESTIC AND INTERNATIONAL LOGISTIC SERVICE?

Logistic service can be broadly defined in two ways; domestic and international. It's easy to assume the difference between these two just by their terms, but actually it isn't when it comes to their different functional sphere.

- **The Basic Line:**

Domestic logistics means distributing goods within you country, while international logistic deals is the transportation of goods beyond your country line. Dealing with domestic transportation is way different than that of international because of proximity involves in the process. Let's take a look at the basic difference of these two operations.

- **Management:**

When searching for local freight transport service you can book in many ways. Metro transport, full truck load and dangerous goods point to point delivery to down the road or to other part in Australia can be done easily within a day or maybe in week. On the contrary, international logistics requires different set of commercial operational managers who will set an entire plan for the delivery overseas.

- **Costs:**

The costs involved in both the process should be considered individually. The price vary based on transportation modes, technology and man power involved. There are additional taxes involved in international process that make it bit too costly than that of domestic.

- **Transportation:**

When transporting within your country boundary, you would be able to choose many transportation options such as truck, metro and other road transportation facilities which are designed for palletized, fork-lifted and skidded. But you have very limited option when moving beyond country's boundary.