

OPERATIONS MANAGEMENT

MODULE IV – MATERIALS MANAGEMENT

INTRODUCTION

Materials Management is a method for planning, organizing and controlling the activities that are related to the flow of materials in a company. This can lead to the control of the location, movement and time of those materials from their introduction, production, manufacturing process and final delivery. Materials management makes sure the materials available are aligned with the customer demands, thus giving a schedule of costs and resources that the company has or needs. Materials management controls the flow of materials with demand, prices, quality and delivery schedules.

Materials Management is vital for the process that is received from raw materials, machinery, production processes, maintenance, among others, because with this management you can order and classify the inventories in the most accurate way. With the Management of Materials, one is responsible for the planning, movement, storage and control of materials to enhance and provide excellent customer service with a predetermined cost that is minimal. The supply chain is linked to materials management as this method is used to plan and supply the organization. Inventory goes hand in hand with this in order to keep track of raw materials and specific products. This helps minimize costs to the organization and ensures maximum return on working capital.

It should be noted that materials are classified by direct materials or indirect materials. Direct materials are those that process and give a finished product, indirect materials are those that do not generate a final product.

Direct materials

Direct materials are those materials or raw materials in which value and importance are identified in order to make the product that is needed and they also represent the cost and benefit of the process. These direct materials are essential

for the quality of the product because without them the product could lose value in the market. They are vital in the inventory and it is not possible to get out of them.

Indirect materials

These are those materials that are part of the production of the product but do not make a difference to the final product. These cannot be calculated or measured, so their presence is not of high relevance in the delivery of the final result.

Fundamental Objectives of Materials Management

These objectives are called the 5 R's of Materials Management; they are the acquisition of materials and services.

- The right material
- At the right time
- In the right amount
- Of the quality that is
- At the right price
- From the right sources

PURCHASE MANAGEMENT

Purchase Management is a function of materials management in a company. Their basic function is procuring the inputs for production function. This function encompasses suppliers in the market external to the organization and several internal to the organization. Till recently, the purchasing process simply involved placing an order with the supplier who offered the lowest price. Nowadays, increase in competition and market demand and scarcity of resources have forced organizations to reexamine their purchasing activities. The purchasing department functions have expanded considerably and include activities such as verifying the credentials of suppliers, inspecting the quality of the material to be purchased, ensuring the timely delivery of the material, etc.

While the value of purchased items varies from industry to industry, it adds up to more than fifty percent of sales in all industries. Purchase management is regarded as a significant activity in many organizations because of the high cost involved in carrying out purchasing activities, increasing quality benchmarks, and increasing

global competition. Purchase departments buy raw materials, parts, machinery, and services used by production systems. The objective of purchase management is to procure the right equipment, materials, supplies and services in the right quantity, of the right quality, from the right suppliers, at the right time, at the lowest price.

Objectives or Goals of Purchase Management

Primary objective or goal of purchasing function is making inputs available to the conversion process at minimum cost to the final output of the company. Thus focus is on system output rather than on micro level objectives.

The inputs to be made available are raw materials, semi finished items, bought out items etc. There are certain parameters to be monitored for fulfilling the system objectives. We can call them goals of purchasing. These goals are popularly known as 5R's of purchase namely, right price, right quantity, right quality, right place and right time. In simple terms, if the above 5Rs are achieved primary objective is fulfilled:-

- **Right Price:** Right price is determined by costing the production process of the supplier. Right price is determined by allowing reasonable profit for the supplier and insisting and helping to reduce cost. Tender system should be used to identify lowest responsible bidder rather than lowest bidder. Principles normally used to ensure right price are cost structure and learning curve.
- **Right Quantity:** Right quantity of purchase is the one that ensures no excess and no shortage. High priority items are subjected to EOQ analysis to determine the right quantity for purchase. This ensures overall minimum cost for inventory.
- **Right Quality:** In an item purchased should ensure adhering to mutually accepted standard by supplier and customer at the time of finalizing the purchase order. The accepted standard may be a drawing, a sample, a grade or a universal standard like DIN, IS, BS etc.
- **Right Place:** is the one where the item is going to enter the value stream. If the item is not available here, when needed, it is in short supply for the process.
- **Right Time:** is as decided by production schedule for meeting customer's requirements

Purchasing cycles

A purchasing cycle shows the steps that a business will go through before making any product purchase. It starts from the knowledge there is a product need, to specifying the quantities required and when they are needed by.

Once a purchase need is identified, the prices and quality of different products and inventory stock from different suppliers needs to be compared before a decision is reached on where to source the goods. A purchase order is then approved, in larger organizations this many require approval from more than one person.

The business and the supplier then negotiate the terms of the purchase contract. At this stage of the purchasing cycle, it may also be determined if this is a one-off sale or whether it will be an ongoing relationship with the chosen supplier. When the stock is receipted into the business, the goods are counted and inspected for quality and then recorded in the company's inventory management system.

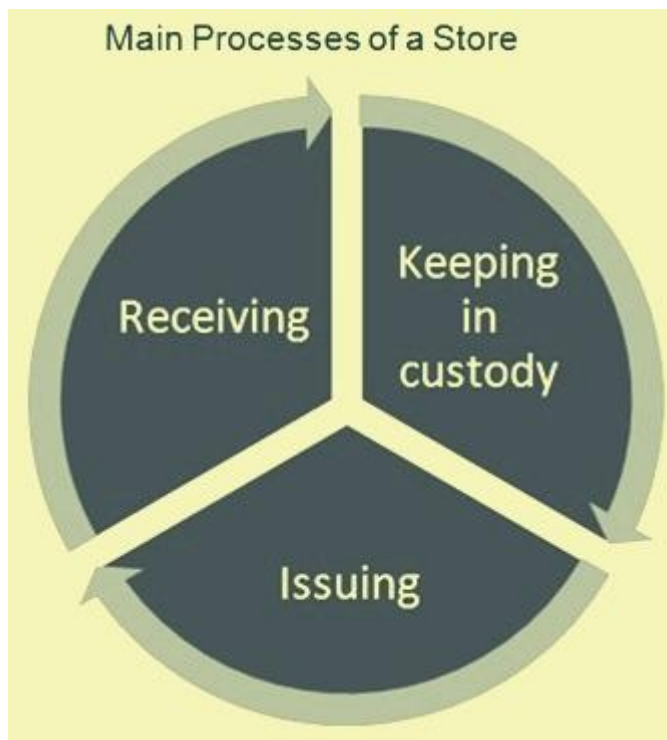
Importance of Purchase Management

Purchase management is considered to be very important function of materials management in a company. Its importance is felt even outside the formal scope of materials management. As the purchase decisions commit a very large portion of financial resource of the company purchase function is said to be highly important. Purchase personnel deal with large number of external agencies while performing their functions. Hence they represent company's reputation in the outside world. As they negotiate and finalize deals worth lot of money for the company their integrity is of utmost importance for the organization.

STORE MANAGEMENT

Store is an important component of material management since it is a place that keeps the materials in a way by which the materials are well accounted for, are maintained safe, and are available at the time of requirement. Storage is an essential and most vital part of the economic cycle and store management is a specialized function, which can contribute significantly to the overall efficiency and effectiveness of the materials function. Literally store refers to the place where materials are kept under custody.

Typically a store has a few processes and a space for storage. The main processes (Fig 1) of store are (i) to receive the incoming materials (receiving), (ii) to keep the materials as long as they are required for use (keeping in custody), and (iii) to move them out of store for use (issuing). The auxiliary process of store is the stock control also known as inventory control. In a manufacturing organization, this process of receiving, keeping in custody, and issuing forms a cyclic process which runs on a continuous basis. The organizational set up of the store depends upon the requirements of the organization and is to be tailor made to meet the specific needs of the organization.



Store is to follow certain activities which are managed through use of various resources. Store management is concerned with ensuring that all the activities involved in storekeeping and stock control are carried out efficiently and economically by the store personnel. In many cases this also encompasses the recruitment, selection, induction and the training of store personnel, and much more.

The basic responsibilities of store are to act as custodian and controlling agent for the materials to be stored, and to provide service to users of these materials. Proper management of store systems provide flexibility to absorb the shock variation in demand, and enable purchasing to plan ahead.

Since the materials have a cost , the organization is to manage the materials in store in such a way so that the total cost of maintaining materials remains optimum.

Store needs a secured space for storage. It needs a proper layout along with handling and material movement facilities such as cranes, forklifts etc, for safe and systematic handling as well as stocking of the materials in the store with an easy traceability and access. It is to maintain all documents of materials that are able to trace an item , show all its details and preserve it up to its shelf life in the manner prescribed or till it is issued for use. Store is to preserve the stored materials and carry out their conservation as needed to prevent deterioration in their qualities. Also store is to ensure the safety of all items and materials whilst in the store which means protecting them from pilferage, theft, damage, deterioration, and fire.

The task of storekeeping relates to safe custody and preservation of the materials stocked, to their receipts, issue and accounting. The objective is to efficiently and economically provide the right materials at the time when it is required and in the condition in which it is required. The basic job of the store is to receive the materials and act as a caretaker of the materials and issue them as and when they are needed for the activity of the organization.

Once the material has been received and cleared through inspection and accepted for use, it needs safe custody of the stores. The role of custody is to receive and preserve the material. A stage comes when the material is needed for use. Store at that time releases the material from its custody to the user department and the

process is called 'issue of goods. It might also happen that after partial use , some materials having useable value in future are returned to the store and thus they also become part of the custody again.

Storekeeping activity does not add any value to the materials. In fact it adds only to the cost. The organization is to spend money on space (expenditure on land, building passage and roads), machinery (store equipment), facilities (e.g. water, electricity, communication etc.), personnel, insurance, maintenance of store equipment, stationary etc. All of these get added to the organizational overheads and finally get reflected in the costing of the finished product. However, it is an essential function in any organization.

Objectives of store management

An efficient stores management has normally the following main objectives.

- To ensure uninterrupted supply of materials without delay to various users of the organization.
- To prevent overstocking and under stocking of the materials
- To ensure safe handling of materials and prevent their damage.
- To protect materials from pilferage, theft, fire and other risks
- To minimize the cost of storage
- To ensure proper and continuous control over the materials.
- To ensure most effective utilization of available storage space
- To optimize the efficiency of the personnel engaged in the store

Classification of stores

Store can be of temporary nature which means that it has a limited life. Store can also be of permanent nature. Stores are classified basically in the following broad categories.

- **Functional stores** – Functional stores are named based on the function of the materials stored. Examples are fuels store, chemicals store, tools store, raw materials store, spare parts store, equipment store, refractories store, electric store, explosives store, and finished goods store etc.
- **Physical stores** – Physically stores can be centralized stores or decentralized stores. These stores are named based on the size and location of the store. Examples are central store, sub store, department store, site store, transit stores, receipt store, intermediate store, open yard store, and covered store etc.
- Stores are also classified by naming them after the departments to which they serve. Examples are construction stores, operation stores, rolling mill stores, blast furnace stores, and steel melting shop stores etc.
- Stores are sometimes classified based on the nature of materials stored in them. Examples are general store, bonded store, perishable store, and inflammable store, salvage store, reject store, and quarantine store etc.

Functions of a store

Store personnel are responsible for carrying out the following functions.

- Receipt of incoming materials
- Supervision of unloading of materials and tallying of materials
- Checking for damages or shortages and preparation of the report

- Filling of 'goods inward', 'day book', or 'daily collection' register
- Completion of vendors consignment note (challan)
- Making arrangement for inspection and getting the inspection completed
- Preparation of 'goods receipt note' (GRN)
- Preparation of 'goods rejection memo' (in case of rejection of materials)
- Sending of materials to the respective stores
- Sending of the relevant documents to the respective departments
- Ensuring all storage and material handling facilities are in proper working order
- Ensuring good housekeeping and cleanliness in the storage space
- Checking, counting and tallying of materials before issue
- Making prompt entries in 'Bin card' or stock card
- Ensuring correct documentation of material receipts and material issues
- Ensuring safe and proper handling of materials so as not to damage them
- Ensuring proper record keeping and correct accounting of materials
- Ensuring regular stock verification
- Ensuring that rules and regulations relating to physical custody and preservation of materials are followed
- Ensuring safety of materials and personnel

VENDOR SELECTION

The vendor selection is a subsidiary process that allows clearly stating, defining and approving those vendors which meet requirements of the procurement

process. The purchasing department takes responsibility for the vendor selection which is an integral part of the procurement management process. The buying department is responsible for creating a list of potential suppliers and submitting that list to the project manager in order to decide on the vendors in conference. However, the ultimate decisions on the vendors cannot be made without vendor selection criteria, so the purchase department in cooperation with the project manager needs to develop and use such criteria.

Often vendor selection criteria vary between organizations; however, they need to be identified and included as a component of the inventory management plan.

The criteria for vendor selection include the following:

- Delivery – an ability of the contractor to procure all required items within desired delivery dates
- Quality of the procurement services – an ability of the contractor to provide products with the expected quality
- Cost of the procurement services – a comparison of prices provided by several contractors
- Past performance – records on the contractor's procurement activities undertaken in the past

Steps for successful Vendor Selection

Below are 7 steps to successful vendor selection:

Step 1: Define and Analyze Business Requirements

What is the organization asking a third party to provide? A good start would be to assemble an evaluation team that is knowledgeable in the vendor selection process and has a clear understanding of what the business is all about. The evaluation team should be able to:

- Define the product, material or service that is needed;
- Define the Technical and Business Requirements;
- Define the Vendor Requirements (i.e. the features the organization is looking for in a vendor), and
- Publish a Requirements Document.

The evaluation team should also try to collect as much information as possible, identify and interview stakeholders and users, review existing internal materials

such as reports, and statistics as well as gather technical information including standards and descriptions of the current technical environment.

Step 2: Identify Third Party Vendor Candidates

After the evaluation team has published a requirements document it must now compile a list of possible vendors. The team should send each one a Request for Information (RFI) and conduct a team evaluation process. A short list of vendors is then created.

Step 3: Develop Evaluation Criteria (with weighting)

In this third step, the team would construct an evaluation model that weighs a requirement against its value and priority. For example, if the vendor meets a requirement with a score of 7 (on a scale of 1 to 10) and the priority of that requirement is 5 (on a scale of 1 to 5), then the response can be scored by 35. This helps to amplify the differences among vendors.

Step 4: Conduct Vendor Briefings

Once the team has developed evaluation criteria with weighting and further narrowed down possible vendor candidates, it's time to set up an initial meeting with each potential vendor to discuss stated requirements and ensure a common understanding.

Step 5: Evaluate Vendors and Schedule Demos

After completion of vendor briefings, the team should be better equipped to evaluate potential vendors. Selected vendors should provide a solution overview to the organization's current business and technological requirements, fees, benefits derived from using a particular vendor, etc. In addition, vendors are requested to provide a "demo" to showcase the capabilities of their solution. Demos are a valuable way to get more information and also evaluate intangible aspects of a vendor. It is critical to check the vendor's references as a part of the evaluation process (site visits are also strongly recommended).

Step 6: Complete Vendor Selection

Primary and Secondary Options:

At the conclusion of the evaluation process, the team will identify a primary option (the winner) and a secondary alternative.

Step 7: Complete Contracting with Vendor

This step includes identifying a clear set of objectives, deliverables, timeframes, and budgets for the project with the vendor. These should be clearly written in the terms of the contract. One of the most important factors in the vendor selection process is to develop a contract negotiation strategy. A successful contract negotiation simply means that both parties will search for positives that will benefit the two parties in every aspect while they achieve a fair and equitable deal.

It is important to be clear about all the important prerequisites, terms and conditions of the contract and to provide precise information on what goods and/or services the vendor should provide. Vendor's compensation should be clearly stated; the total cost, the schedule for payment and financing terms. There should also be acknowledgement of the following: Effective dates/Renewal dates/Completion dates/Termination dates.

INVENTORY MANAGEMENT

‘Inventory refers to the stockpile of the product a firm is offering for sale and the components that make up the product.’ In short, inventory is such type of assets which will be disposed of in future in the ordinary course of the business.

In other words, ‘Inventory’ is used to designate the aggregate of those items of tangible assets which are:

- (i) Held of sale in ordinary course of the business;
- (ii) In the process of production for such sale; or
- (iii) To be currently consumed in the production of goods or services to be available for sale.

Thus, it means and includes:

(i) Raw Materials & Stores — (Consumable):

It contains items which are purchased by the firm from others.

(ii) Work-in-Progress — (Convertible):

It consists of items which are currently used in the production process. These are semi-finished goods that are held at various stage of production in multi-stage production process.

(iii) Finished goods — (Saleable):

It represents final or completed products which are available for sale.

In financial management, however, inventory is defined as the sum total of raw materials, work-in-progress and finished products although it depends largely upon the type of business.

For example, in case of manufacturing concern, inventory will mean and include all the three groups stated above while, in case of a trading concern, it will represent only the finished goods. Manufacturing concerns hold inventories to give flexibility between production and sales.

Objectives of Inventory Management:

Efficient inventory management should result in the maximization of the owner's wealth. For this purpose, a firm should neither hold excessive inventories nor hold inadequate inventories, i.e., it should hold the optimum level of inventory. The optimum level of inventory investment lies between the point of excessive and inadequate levels.

In other words, there must not be an over investment or under investment in inventories.

The dangers of over investment in inventories are:

(i) Funds of the firm are tied-up unnecessarily;

(ii) It creates loss of profit;

(iii) Excessive carrying cost and risk of liquidity increases.

As such, the opportunity cost and carrying costs (viz., cost of storage, handling, insurance etc.) increase proportionately. No doubt, these costs will impair the profitability of the firm. Excessive investment in raw materials will prove the same result except at the time of inflation and scarcity. Similar results may also be noticed for the over investment in work-in-progress since it is very difficult to sell. Similarly, many difficulties will appear to dispose of excessive finished goods since time lengthens (viz., the goods may be sold at low price etc.).

Moreover, for carrying excessive inventory physical deterioration of the same may occur while in storage. From the above, it becomes crystal clear that there must not be an over investment in inventories. Similarly, inadequate level of inventories is not also free from snags.

INVENTORY COST

(i) Ordering/Acquisition/Set-up Costs, and

(ii) Carrying Costs.

(i) Ordering/Acquisition/Set-up Costs:

These are the variable costs of placing an order for the goods. Orders are placed by the firm with suppliers to replenish inventory of raw materials. Ordering costs include the cost of requesting, purchasing, ordering, transporting, receiving, inspecting and storing. The ordinary costs vary in proportion to the number of orders placed.

They also include clerical costs and stationery costs (That is why it is called a set-up cost). Although, these costs are almost fixed in nature, the larger the order placed, or the more frequent the acquisition of inventory made, the higher are such costs. Similarly, the fewer the orders, the lower the order cost will be for the firm. Thus, the ordering/acquisition costs are inversely related to the level of inventory.

(ii) Carrying Cost:

These are the expenses of storing goods, i.e., they are involved in carrying inventory.

The cost of holding inventory may be divided into:

(i) Cost of Storing the Inventory and

(ii) Opportunity Cost of Funds.

(i) Cost of Storing the Inventory:

(a) Storage Cost (i.e., tax, depreciation, insurance, maintenance of building etc.);

(b) Insurance (for fire and theft);

(c) Obsolescence and Spoilage;

(d) Damage or Theft;

(e) Serving Costs (i.e., clerical, accounting costs etc.).

(f) Cost of running out of goods.

(ii) Opportunity Cost of Funds:

This includes the expenses in raising funds (i.e. Interest on Capital) which are used for financing the acquisition of inventory.

The level of inventory and the carrying costs are positively related and move in the same direction, i.e., if inventory level decreases, the carrying costs also decrease and vice-versa.

INVENTORY MANAGEMENT TOOLS

That being said, inventory management is only as powerful as the way you use it.

It's well worth the extra time and money to have inventory management set up by the experts who made the software. Work with them to make sure you're utilizing the proper techniques and features to get the most bang for your buck.

Let's take a look at some inventory-control techniques you may choose to utilize in your own warehouse.

1. Economic order quantity.

Economic order quantity, or EOQ, is a formula for the ideal order quantity a company needs to purchase for its inventory with a set of variables like total costs of production, demand rate, and other factors. The overall goal of EOQ is to minimize related costs. The formula is used to identify the greatest number of product units to order to minimize buying. The formula also takes the number of units in the delivery of and storing of inventory unit costs. This helps free up tied cash in inventory for most companies.

2. Minimum order quantity.

On the supplier side, minimum order quantity (MOQ) is the smallest amount of set stock a supplier is willing to sell. If retailers are unable to purchase the MOQ of a product, the supplier won't sell it to you. For example, inventory items that cost more to produce typically have a smaller MOQ as opposed to cheaper items that are easier and more cost effective to make.

3. ABC analysis.

This inventory categorization technique splits subjects into three categories to identify items that have a heavy impact on overall inventory cost.

- Category A serves as your most valuable products that contribute the most to overall profit.
- Category B is the products that fall somewhere in between the most and least valuable.
- Category C is for the small transactions that are vital for overall profit but don't matter much individually to the company altogether.

4. Just-in-time inventory management.

Just-in-time (JIT) inventory management is a technique that arranges raw material orders from suppliers in direct connection with production schedules.

JIT is a great way to reduce inventory costs. Companies receive inventory on an as-needed basis instead of ordering too much and risking dead stock. Dead stock is

inventory that was never sold or used by customers before being removed from sale status.

5. Safety stock inventory.

Safety stock inventory management is extra inventory being ordered beyond expected demand. This technique is used to prevent stockouts typically caused by incorrect forecasting or unforeseen changes in customer demand.

7. FIFO and LIFO.

LIFO and FIFO are methods to determine the cost of inventory. FIFO, or First in, First out, assumes the older inventory is sold first. FIFO is a great way to keep inventory fresh.

LIFO, or Last-in, First-out, assumes the newer inventory is typically sold first. LIFO helps prevent inventory from going bad.

8. Reorder point formula.

The reorder point formula is an inventory management technique that's based on a business's own purchase and sales cycles that varies on a per-product basis. A reorder point is usually higher than a safety stock number to factor in lead time.

9. Batch tracking.

Batch tracking is a quality control inventory management technique wherein users can group and monitor a set of stock with similar traits. This method helps to track the expiration of inventory or trace defective items back to their original batch.

CONCEPT OF EOQ

Definition: Economic Order Quantity (EOQ) is a production formula used to determine the most efficient amount of goods that should be purchased based on ordering and carrying costs. In other words, it represents the optimal quantity of inventory a company should order each time in order to minimize the costs associated with ordering and holding inventory.

What is the definition of economic order quantity? The benefit for an organization to spend time calculating EOQ is to minimize its inventory costs and,

in turn, make strides toward being as efficient as possible. A business can use this calculation to determine exactly when an order needs to be placed and exactly how much should be ordered so that the company can continue normal production and minimize inventory costs.

EOQ is an extremely effective tool for managers because they can use it to figure out what is the optimal amount of inventory to hold on hand as well as to calculate when to order more merchandise because new sales should be generated.

The EOQ formula is ;

$$EOQ \text{ or } E = \sqrt{\frac{2AP}{S}}$$

where, A = the annual consumption, i.e., annual quantity used in units.

P = the ordering cost/cost per purchase order.

S = the annual cost of carrying one unit in stock for one year i.e., carrying cost percentage \times cost of one unit

The EOQ model is illustrated below with the help of the following diagram:

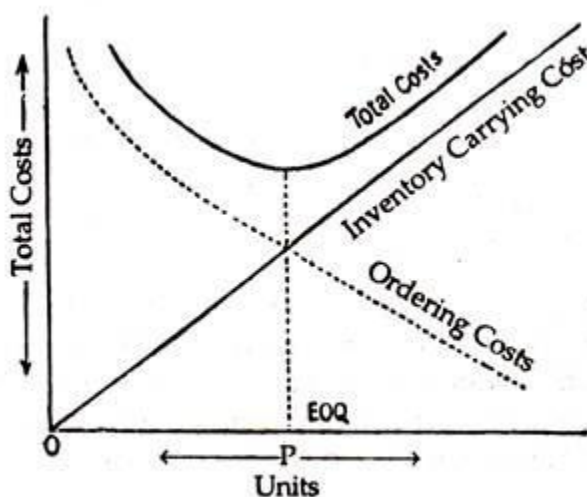


Fig.8.11 No. of units per order.

In the above diagram, the ordering costs, inventory carrying cost and the total costs are plotted. The diagram shows that the carrying costs vary directly with the size of the order whereas ordering costs vary inversely with the size of the order. The total cost (i.e., the sum of two costs) curves at first go downwards due to the fact that at this stage the fixed costs of ordering are spread over many units.

But at the next stage, this curve goes upward because of the fact that at this stage, decrease in average ordering costs is more than what is offset by the additional inventory carrying costs. The point P denotes the optimum order where the total cost is the minimum. Therefore, UP units are considered as the EOQ.

It should be remembered that the EOQ is not a stock level. It lies between the Maximum Stock Level and Minimum Stock Level. However, the EOQ will be determined in such a way as would help in earning the advantages of bulk purchases on the one side, and would keep the other costs (such as interest on capital) as minimum as possible on the other.

The above model is based on the following assumptions:

- (i) The supply position of the materials will be in such a way as will enable a firm to place as many order as it desires,
- (ii) Cost of materials or finished goods remains constant during the year;
- (iii) Quantity-discount is not allowed;
- (iv) Production and/or sales are evenly distributed over the period under consideration; and
- (v) Variable inventory carrying cost per unit and ordering cost per order remain constant throughout the year.

PRACTICAL PROBLEMS

Problem 1: The John Equipment Company estimates its carrying cost at 15% and its ordering cost at \$9 per order. The estimated annual requirement is 48,000 units at a price of \$4 per unit.

Required:

- (i). What is the most economical no. of units to order?
- (ii). No. of orders to be placed in a year.
- (iii). About how often will an order need to be placed?

Solution**(i). Economical No. or Units to Order:**

Annual requirement = 48,000 units

Ordering cost = \$9 per order

Carrying cost = 15% of per-unit cost.

Per unit cost = \$4 per unit

$$\begin{aligned}
 \text{EOQ} &= \sqrt{\frac{2 \times \text{AR} \times \text{OC}}{\text{CC}}} \\
 &= \sqrt{\frac{2 \times 48,000 \times 9}{4 \times 15\%}} \\
 &= \sqrt{\frac{864,000}{0.6}} \\
 &= \sqrt{1,440,000} \\
 &= 1,200 \text{ units}
 \end{aligned}$$

(ii). No. of orders to be placed in a year:

$$\begin{aligned}
 &= \text{Annual requirement} / \text{EOQ} \\
 &= 48,000 \text{ units} / 1,200 \text{ units} \\
 &= 40 \text{ orders}
 \end{aligned}$$

(iii). About how often will an order need to be placed (i.e. frequency of orders):

$$\begin{aligned}
 \text{Frequency of orders} &= \text{No. of days in one year} / \text{No. of orders} \\
 &= 360 \text{ days} / 40 \text{ orders} \\
 &= 9 \text{ days}
 \end{aligned}$$

Problem 2: A manufacturing company placed an order of 24,000 units semiannually at a price of \$20 per unit. Its carrying cost is 15% and the order cost is \$12 per order.

Required:

- (i). What is the most economical order quantity?
- (ii). How many orders need to be placed?

Solution

Computation of Annual Requirement:

24,000 units are ordered semiannually, therefore:

Annual requirement = 24,000 units x 2 = 48,000 units.

$$\text{EOQ} = \sqrt{\frac{2 \times \text{AR} \times \text{OC}}{\text{CC}}}$$

$$= \sqrt{\frac{2 \times 48,00 \text{ units} \times \$12}{\$20 \times 15\%}}$$

$$= \sqrt{\frac{1,152,000}{3}}$$

$$= \sqrt{384,000}$$

$$= 620 \text{ units approximately}$$

No. of orders per year = Annual Requirement / EOQ
= 48,000 units / 620 units
= 77 orders approximately

Practice Problem 1: Calculate **Economic Order Quantity (EOQ)** from the following:

Annual consumption 6,000 units

Cost of ordering Rs. 60

Carrying costs Rs. 2

Ans (600 Units)

Practice Problem 2: From the following particulars, calculate the Economic Order Quantity (EOQ):

Annual requirements 1,600 units

Cost of materials per units Rs. 40

Cost of placing and receiving one order: Rs. 50

Annual carrying cost for inventory value 10%

Ans (200 units)