Inventory control

Significance/importance of inventory control

Material is one of the basic resources for manufacturing unit. It is impossible to conduct manufacturing activities without materials. Materials also termed as stock or inventory.

There are two types of capital viz. fixed capital or block capital and working capital or current capital. The fixed capital is utilized to arrange the basic requirements such as machines and equipments, buildings etc. It has no relation with the volume of production. It is one time investment normally. The current capital is required to meet the day to day expenses i. e. to run the industry we need current capital. It has close bearing with volume of production. As the volume of production increases, the need of current or working capital increases. One of the dominant elements of the current capital is the expenses/investment/cost towards materials. It normally contributes more than 50% of the working capital.

Every organization is intended to increase the profit. Normally total cost is added to profit in order to determine sales price. In the competitive market situation; it cannot be possible to increase sales price after specific limit as there is danger of loss of market due to high sales price. Only one way is possible to maintain the appropriate sales price is that minimize total cost of manufacturing. One of the dominant elements of the manufacturing cost is the cost of material used for producing a product. That is; if you minimize in terms of cost of materials used then there could be possibility of reducing total cost of the product. It is assumed that if you can save 1% in terms of materials cost then there could be possibility of reducing the total cost of the product by 7 to 8%. Materials management or inventory control is considered as cost saving mine. Inventory control is considered as a significant tool to increase return on investment (ROI). ROI is the ratio of profit to investment. Higher ROI assures higher profit.

Only three basic questions are important in order to control the cost of materials and related cost.

i.   What to purchase? (the product, item, material)

ii.   When to purchase? (on the time horizon) and

iii.   How much to purchase? (Order quantity)

Referring to genesis, in industries there were two departments viz. purchasing and stores. Purchasing department was responsible for purchase or procurement of required materials for manufacturing. The

stores department was responsible for storing the material and issuing the same to the respective department and keeping the records for the same. Further, the need is identified to apply control over the materials or inventory. Control allows us identify the deviation in between in planned and actual and guides to initiate the feedback or corrective action.

Further, as it is realized that just 'control' management function is not sufficient looking at the materials role in manufacturing, all the management functions such as plan, organize, control etc. needs to be applied; and the concept of 'Materials management' is coined.

As we are witnessing the era of computerization, computers can be effectively used for managing materials and related cost. The use of computer allows us to provide realistic and readily available data regarding materials which is very beneficial for continued production and minimizing total cost by reducing materials cost. 'Materials requirement Planning-I' can be package which can be used for this purpose. It is also realized the importance of realistic and readily available data by other departments. The data used by the materials department is also useful for the other departments such as finance, sales, production etc. The scope of Materials Requirement Planning has increased and the package is called as 'Manufacturing Resource Planning-II (MRP-II)'. These developments continued further and resulted in other packages used such as Enterprise Resource Planning (ERP), SAP etc.

Organizations are attempting to maintain required flow of production as per the demand with the minimum materials and related costs. The concepts such as JIT-Just in Time, Supply Chain Management (SCM) are few examples for the same.

Definition of inventory and inventory control

The word inventory means a physical stock of material or goods or commodities or other economic resource that are stored or reserved or kept in stock or in hand for smooth and efficient running of future affairs of an organisation at the minimum cost of funds or capital blocked in the form of materials or goods (inventories).

The function of directing the movement of goods through the entire manufacturing cycle form requisitioning of raw materials to the inventory of finished goods in an orderly manner to meet the objectives of maximum customer service with minimum investment and efficient (low cost) plant operation is termed as inventory control.

Types of inventories/Classification of inventories

Inventories may be classified as those which play direct role during manufacture or part of final product and the second one are those which are required for manufacturing but not as a part of production or cannot be identified as a part of product. The first type is labeled as **direct inventories** and the second one as **indirect inventories.**

Further classification of direct and indirect inventories is as follows.

(A) Direct inventories

i. **Raw material inventories**

   The inventory of raw materials is the materials used in the manufacture of product and can be identified as the part of the product. Examples – sugar cane in sugar industries, cloth in garment industries.

ii. **Work-in-process inventories**

   These inventories are of semi-finished type, which are accumulated between operations or facilities. That is some of the operations are carried out and few more are needed to turn it into final product.

iii. **Finished goods inventories**

   After finishing the production processes and packing, the finished products are ready for shipment.

iv. **Bought out products**

   These are the products which are directly going into the product such as bearing, key etc and supplied by vendor.

(B) Indirect inventories

i. **Tools**

   The tools can be of two types- hand tools and machine tools. The stock of the tools is required to be maintained for interrupted production.

ii. Supplies

Supplies such as oil, gas, lubricating oil, cotton waste etc are used during production.

Costs associated with inventory

There are four costs associated with inventory

i. Inventory carrying cost or inventory holding cost
ii. Purchasing cost
iii. Shortage or stock cost and
iv. Set up cost

i. Inventory carrying cost or inventory holding cost

This cost arises due to holding of stock of material in stock. This cost includes the cost of maintaining the inventory and is proportional to the quantity of material held in stock and the time for which the material is maintained in stock. The components of inventory carrying cost are

a. Rent for the building in which the stock is maintained if it is rented building. In case it is own building, depreciation cost of the building is considered.
b. It includes the cost of equipment if any and cost of racks and any special facilities used in stores
c. Interest on the money blocked in the form of inventory or on the money invested in purchasing the inventory
d. The cost of stationery used for maintaining the inventory
e. The wage of personnel working in the stores
f. Cost of depreciation, insurance etc
g. Cost of depreciation and obsolescence of the material stored

This is generally represented as Rs/unit quantity for production model. For purchase model it is represented as *i* % of average inventory. More we store or hold the inventory, more will be the inventory carrying cost.

ii. Purchasing/ordering/replenishment cost

Purchasing cost includes number of cost elements incurred due to purchasing cycle. Purchasing cycle includes the various elements such as identification of need, purchasing enquiry, asking for quotations form supplier, preparation of comparative statement, placing an order, expediting placed order,

inspection cost at the vendor's place, inspection prior to acceptance, receiving the material, issuing the material etc.

The purchasing cost is calculated as purchasing cost per order. It is directly proportional to the number of orders placed.

iii. Shortage or stock cost

This cost arises due to unavailability of material. Due to shortage or stock out of material the various costs may arise such as loss of sales and forgone profit, loss of reputation etc.

iv. Set up cost

Machines require time to make them ready for production; the time is called as set up time. During this time the machine will be idle and labour on the machine too. If we produce with the single set up then the cost will be the minimum, otherwise if it requires to produce with number of set ups due to non availability of material the cost increases.

Economic Order Quantity (EOQ)

F. Harries first developed the concept of Economic Order Quantity in 1916. The two costs viz. inventory carrying cost and purchasing cost are considered for the purpose of analysis. If purchasing is carried out frequently, the purchasing cost increases but at the same time inventory carrying cost decreases. On the other hand if purchasing frequency is reduced then the purchasing cost will reduce, but due to higher order quantities inventory carrying cost will increase.

There is need to find out the trade-off in between purchasing cost and inventory carrying cost. The associated order quantity to the trade-off is called as **Economic Order Quantity**.
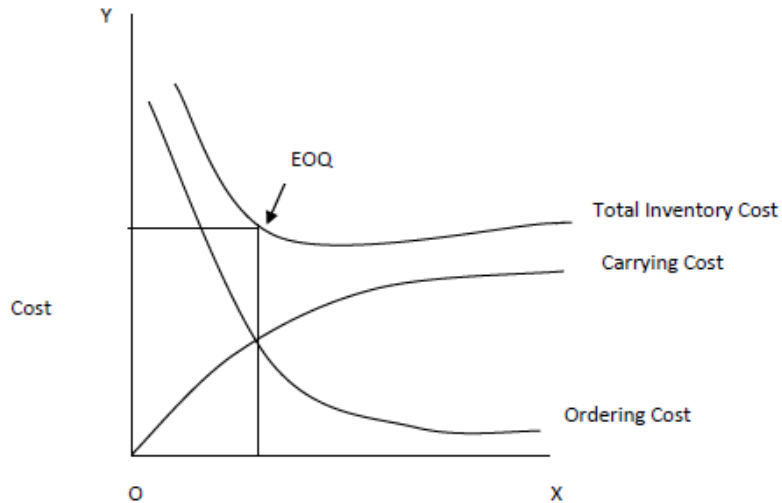
Assumptions in EOQ model

The following are the assumptions with EOQ inventory model

i.   The demand is constant, which normally carried out on annual basis.

ii.   Purchasing cost per order is constant.

iii. Inventory carrying cost is constant.

iv.   The price per unit of the material is constant.

v.   The cost of detoriation and obsolescence of the material stored is negligible.

vi.   Replenishment is instantaneous. There is no lead time.

vii. There is no stock out or shortage of material.

Let

S – Annual demand in units

C_u- Unit price Rs/unit

C_p- Purchasing cost per order

I – Inventory carrying cost expressed as a percentage of average inventory investment.

q – Order quantity

q_0 – Economic order quantity

n – frequency of purchasing

Annual Total inventory cost = Annual purchasing cost + Annual inventory carrying cost

Annual purchasing cost = Number of orders/year X Purchasing cost/order

$$= \frac{Annual\,demand}{order\,quantity} X purchaing\,\cos t\,per\,order$$

$$= \frac{S}{q} X C_p$$

Annual inventory carrying cost= Average inventory level X inventory carrying cost

= Avg. inventory level X unit price X i

$$= \frac{q}{2} X C_u X i$$

Hence

Annual Total inventory cost = $\frac{S}{q} X C_p + \frac{q}{2} X C_u X i$

For minimizing annual total inventory cost differentiating above equation w.r.t. q and equating to zero, we get the economic order quantity q_0 as

$$q = q_0 = \sqrt{\frac{2SC_p}{C_u X i}}$$

Problem 1

The demand for an item is 8000 items per annum and the unit cost is Re. 1. Inventory carrying charges are 20% of average inventory cost and ordering cost is Rs 12.50 per order. Calculate optimal order quantity, optimal order time, optimal inventory cost and number of orders.

Solution:

Data: Annual Demand = S = 8000 units

Unit price = C_u = Re. 1

Inventory carrying cost = I = 0.20

Ordering cost = C_p = Rs. 12.50 per order

Optimal order quantity

$$q_0 = \sqrt{\frac{2SC_p}{C_u Xi}}$$

$$q_0 = \sqrt{\frac{2 X 8000 X 12.50}{1 X 0.20}} = 1000 units$$

Optimal number of orders

$$= \frac{Annual demand}{Order quantity} = \frac{8000}{1000} = 8$$

Optimal order time

$$= \frac{Year}{No. of orders} = \frac{12}{8} = 1.5 months / order$$

Optimum inventory carrying cost

$$= \frac{q_o}{2} XC_u Xi = \frac{1000}{2} X 1 X 0,20 = Rs 100$$

Problem 2

A stockiest has to supply 400 units of a product every Monday to his customers. He gets the product at Rs 50 per unit from the manufacturer. The cost of ordering and transportation from the manufacturer is Rs 75 per order. The cost of carrying inventory is 7.5% per year of the cost of the product. Find

i. Economic lot size

ii. The total annual inventory cost including material cost and

iii. The saving through economic order quantity purchase if the stockiest had a policy of purchasing with order quantity of 2000 units.

Solution:

Data: Annual Demand = S = 400 X 52 = 20800 units (Assuming that a year cosmists of 52 weeks)

Unit price = C_u = Rs. 50

Inventory carrying cost = I = 0.075

Ordering cost = C_p = Rs. 75 per order

Optimal order quantity

$$q_0 = \sqrt{\frac{2SC_p}{C_u Xi}}$$

$$q_0 = \sqrt{\frac{2 X 20800 X 75}{50 X 0.075}} = 912 units$$

Total cost including material cost = Annual total inventory cost + Material cost

Annual Total inventory cost = $\frac{S}{q} XC_p + \frac{q}{2} XC_u Xi$

$$= \frac{20800}{912} X 75 + \frac{912}{2} X 50 X 0.075$$

= 1710 +1710 = Rs 3420

Material cost = Annual demand X unit price

= 20800 X 50 = Rs 1040000

The saving through economic order quantity purchase if the stockiest had a policy of purchasing with order quantity of 2000 units

For order quantity 2000 units

Annual Total inventory cost = $\frac{S}{q} XC_p + \frac{q}{2} XC_u Xi$

$$= \frac{20800}{2000} X 75 + \frac{2000}{2} X 50 X 0.075$$

= 780 +3750 = Rs 4530

As the material cost remains the same, the savings through Economic order quantity purchases

= Rs (4530 – 3420) = Rs 1110

Selective Inventory Control techniques

Industry uses variety of inventories. In order to control total cost associated with inventories and to ensure smooth flow of production with adequate supply of materials, selective inventory techniques are used.

1. **ABC Analysis**

   ABC analysis may be defined as a technique where inventories are analyzed with respect to their value so that items are given importance and care by the management. Three categories are created namely A, B and C. The following table represents the appropriate classification of items along with their value and quantity.

Category	% of total value	% of total quantity
A	70-80	5-10
B	20-25	20-30
C	5-10	60-70

   A type of items are the costliest as they are contributing the highest % of total value and their requirement in terms of quantity is the least. Hence, the purchases of such items are required to be carried out as when required in order to avoid unnecessary blockage of capital.

   C type of items are the cheapest as they are contributing the least % of total value and their requirement in terms of quantity is the highest. Hence, the purchases of such items are required to be carried out in bulk in order to avail quantity discounts and to avoid shortage.

   B type of items has the moderate usage value and moderate usage quantity. It is recommended to purchase through economic order quantity to optimize total inventory associated costs.

2. **VED Analysis**

   VED stands for Vital, Essential and Desirable. Highest control is over vital items, medium control is exercised over essential items and least control is inferred over desirable items. This technique is preferably used in spare parts management.

3. **SDE Analysis**

SDE stands for Scare, Difficult and Easy. Highest control is over scare items, medium control is exercised over difficult items and least control is inferred over easily available items.

4. **FSN Analysis**

FSN stands for Fast moving (F), slow moving (S) and Non moving (N). This is based on the issues from stores. Highest control is kept over fast moving items, medium control is exercised over slow moving items and the least control is inferred on non-moving items.

5. **S-OS Analysis**

Inventories are classified as seasonal and off seasonal depending on their availability. The purchases of items planned accordingly.

6. **GOLF Analysis**

Depending on the supplier, the inventories are classified as Government, Local and Foreign. Depending on nature of supplier, the purchase procedure can be planned and executed.

Theory Questions to prepare

i. Explain the importance of inventory control.
ii. State the various types of costs associated with inventory.
iii. Explain the various types of inventories.
iv. What do you understand by 'Economic Order Quantity'?
v. State the various assumptions with Economic order quantity model.
vi. Derive an expression for Economic Order Quantity.