INVENTORY MANAGEMENT AND CONTROL

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LECTURE CONTENT

- Inventory Meaning
- Function of Inventory
- Types of Inventory
- Cost Associated with Inventory
- Techniques of Inventory Control (EOQ and ABC analysis)
- Stock Keeping

Inventory – Meaning

- Inventory can be described as an expensive and important current asset of the manufacturing company, representing as much as fifty percent of the total invested capital.
- It can also be described as any stored resource used to satisfy the current or future needs of the customers.

Examples – Raw Materials, Work-in-progress, Finished Goods

Functions of Inventory

- To "decouple" or separate various parts of the production process.
- To provide a stock of goods that will provide a "selection" for the customers.
- To take advantage of quantity discount.
- To hedge against inflation and upward price changes.

Types of Inventory

Four kinds of inventories may be identified:

1. **Raw materials Inventory:** This consists of basic materials that have not yet been committed to production in a manufacturing firm. Raw materials that are purchased from firms to be used in the firm's production operations range from iron ore awaiting processing into steel to electronic components to be incorporated into stereo amplifiers. The purpose of maintaining raw material inventory is to uncouple the production function from the purchasing function so that delays in shipment of raw materials do not cause production delays.

2. **Stores and Spares:** This category includes those products, which are accessories to the main products produced for the purpose of sale. Examples of stores and spares items are bolts, nuts, clamps, screws etc. These spare parts are usually bought from outside or some times they are manufactured in the company also.

3. **Work-in-Process/Semi-Finished Goods Inventory:** This category includes those materials that have been committed to the production process but have not been completed. The more complex and lengthy the production process, the larger will be the investment in work-in-process inventory. Its purpose is to uncouple the various operations in the production process so that machine failures and work stoppages in one operation will not affect the other operations.

4. **Finished Goods Inventory:** These are completed products awaiting sale. The purpose of finished goods inventory is to uncouple the productions and sales functions so that it no longer is necessary to produce the goods before a sale can occur.

Cost Associated with Inventory

Usually there are 4 types of cost associated with any types of Inventory which are given as below:

- Ordering Cost
- Holding Cost
- Purchase Cost
- Set-up Cost

1. Ordering Cost: -The cost which is incurred in placing and receiving the order for the inventory is called as Ordering Cost. It includes various expense heads such as Ordering Form, Tender Cost, Cost of Stationary, Clerical support etc.

2. Holding Cost: - The cost which is associated with holding or carrying the inventory in proper conditions is called as Holding or Carrying cost. It includes various expense heads such as Cost of Warehousing, Security, Insurance, Interest, Pilferage, Obsolescence etc.

3. Purchase Cost:- It includes the amount which the buyers pays to the supplier for purchasing the inventory item. It takes into consideration any quantity discount being offered by the supplier along with the shipping charges.

4. Setup Cost:- It include the cost which is incurred in preparing a machine or process for manufacturing any order. It includes various expenses such as Clean-up cost, Re-tooling cost etc.

Techniques of Inventory Control

- **Economic Order Quantity or EOQ**: It is one of the oldest and the most popular inventory control technique. The term EOQ can be defined as an order quantity at which the total cost comprising of the ordering and holding cost is at the minimum. It is considered to be an important inventory control technique since it helps the production manager in determining the appropriate order quantity which results in incurring the lower inventory cost in line with estimated market demand.
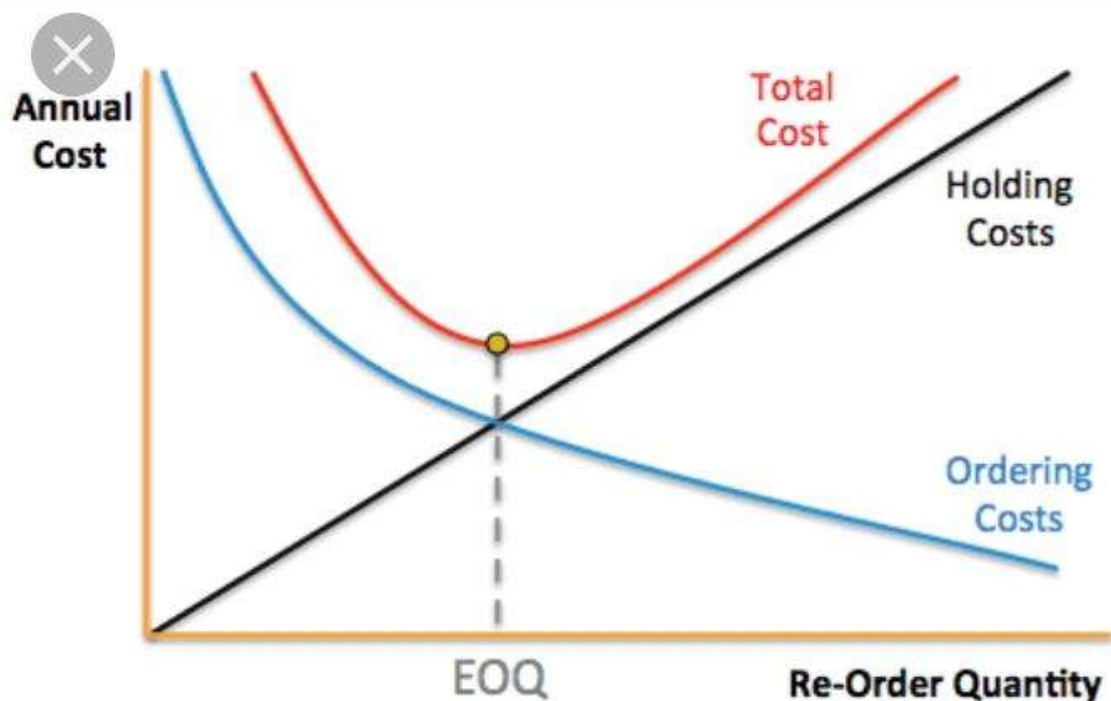
In the above graph we can notice that when the order quantity (represented on x-axis) increases, the Ordering cost decreases whereas the inventory holding cost (cost of storage, insurance etc.) will increase.

Thus in the production process there are two opposite cost; one encourages the increase in the order size while the other discourages. Economic order quantity or EOQ is therefore that order quantity or size at which the total annual cost (represented by y-axis) is minimum and the ordering cost is equal to the holding cost.

Following are the assumptions to be kept in mind while calculating EOQ:

1. Demand for the product is constant and is uniform throughout the period.
2. Lead time is zero.
3. Total Annual cost comprises of only Ordering and Holding Cost.
4. Holding cost is expressed as % of average inventory.

Formula for calculating Economic Order Quantity (EOQ)

$$EOQ\ (Q) = \sqrt{2DS/HC}$$

Where,

D = Annual Demand of the product

S= Ordering Cost per unit of item

H = Holding cost expressed as % of average inventory

C = Purchase Cost per unit of item

Example 1:

The ABC Co. is planning to stock a new product. The Co. has developed the following information:

Annual usage = 5400 units ; Cost of the product = Rs. 365 per unit; Ordering cost = Rs. 55 per unit/order; Carrying cost = 28% per year of inventory value held.

a Determine the optimal number of units per order.

b. Find the optimal number of orders/year.

c. Find the annual total inventory cost.

Solution:

(a) We know that formula for calculation of EOQ is $\sqrt{2DS/HC}$

Thus, $Q = \sqrt{2*5400*55} / 0.28 * 365 = 76$ units per order.

(b) The optimum number of order per year would be D/Q

    i.e   5400 / 76 = 71 order per year

(c) Annual Total Inventory Cost (TC) = DC + DS/Q + QHC/2

i.e TC = 5400 * 365 + (5400/76) * 55 + (76 * (0.28 * 365) / 2)

=> TC = 1971000 + 3905 + 3876 = 19,78,781

Example 2:

For a certain product purchased from a vendor at Rs. 42 per unit, the ordering cost is Rs. 16 per unit. The inventory carrying cost is 0.20 paisa per rupees per order and sales are relatively constant at 1800 units per year.

        a. What is the optimal order quantity?
        b. What is the annual total inventory cost?

Solution:

(a) We know that formula for calculation of EOQ is $\sqrt{2DS/HC}$

Thus, $Q = \sqrt{2*1800*16} / 0.20 * 42 = 82.8$ or 83 units per order.

(b) Annual Total Inventory Cost (TC) = DC + DS/Q + QHC/2

i.e TC = 1800 * 42 + (1800/83) * 16 + (83 * (0.20 * 42) / 2)

= 75600 + 347 + 349 = 76296

- **ABC Analysis of Inventory Control**

Also called as Always Better Control, in this analysis it is presumed that all the items stored in the inventory vary in their importance and hence an appropriate level of control should be exercised on each of these items considering the cost associated with exercising proper level of such control.

Thus in this technique all the items available in the inventory are classified into three category A, B and C on the basis of their importance and monetary value. The term importance can be defined from a number of perspective which are as follows:

(a) Unit Purchase Price

(b) Annual Consumption Value

(c) Criticality in manufacturing operation

(d) Consumption Rate

(e) Availability

(f) Inventory level or position

The items which are placed in A category are the ones which are most important and has high consumption value; those placed in B category are relatively less important and has moderate consumption value; while those in C category are not important and has very less consumption value.

The division of items into various categories can be shown with the help of chart given below
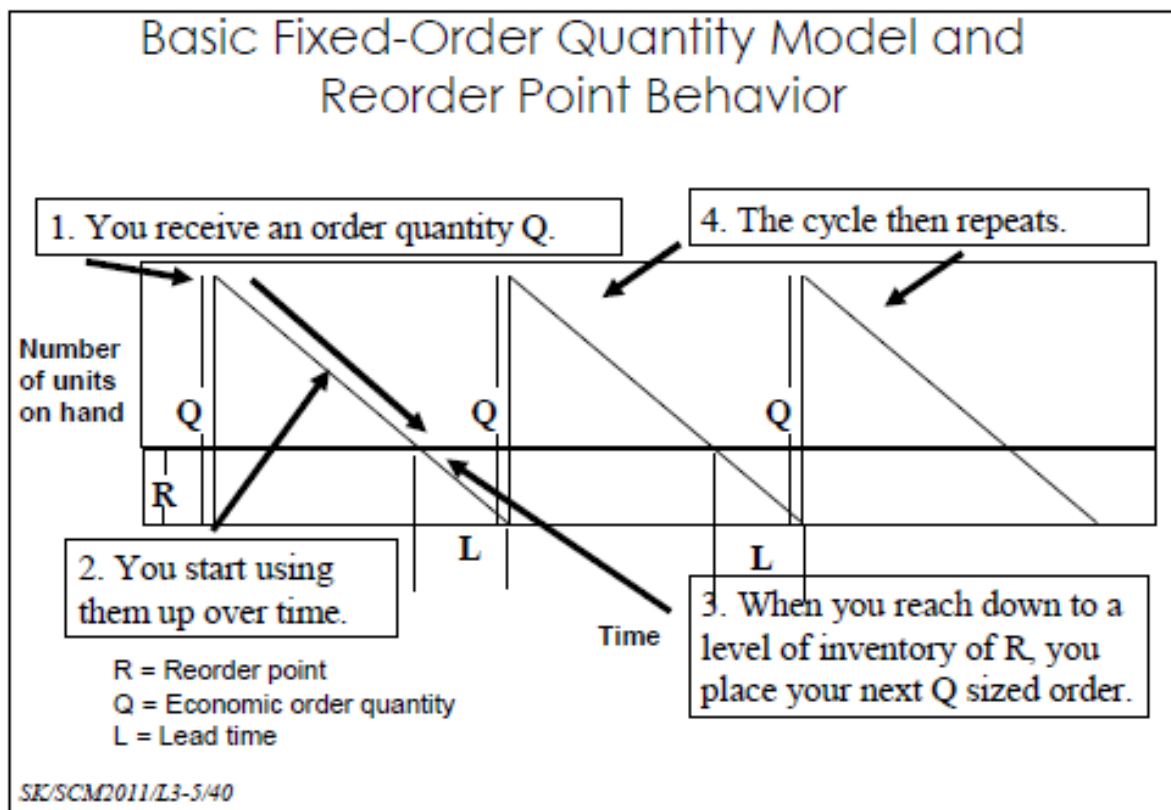
Class	No. of item in use (%)	Consumption Value (%)
A	20	80
B	30	15
C	50	5
Total	100	100

Due to its selective approach, this analysis or technique of inventory control is also called as "**Selective technique of Inventory Control**".

Inventory Management System

Fixed Order Quantity Model: This model assumes a maximum and minimum level of inventory and the constant rate of demand and consumption in the market where a fixed order quantity denoted by Q (EOQ) is placed whenever the stock reaches a fixed point called as *Re-order Point*.

Usually there is some amount of time period which elapses between placing of the order and the receiving of the order which is usually called as *Lead Time*.

Basic Fixed-Order Quantity Model and Reorder Point Behavior

1. You receive an order quantity Q.

4. The cycle then repeats.

Number of units on hand

Q

R

2. You start using them up over time.

L

Time

L

3. When you reach down to a level of inventory of R, you place your next Q sized order.

R = Reorder point
Q = Economic order quantity
L = Lead time

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However, after placing the order the consumption continues as the demand keeps on coming and hence there should be a certain level of stock which should be maintained between the re-order point and the minimum level of inventory, which is called as *Reserve Stock* for handling of market demand during lead time.

Stock-Out Occurrence
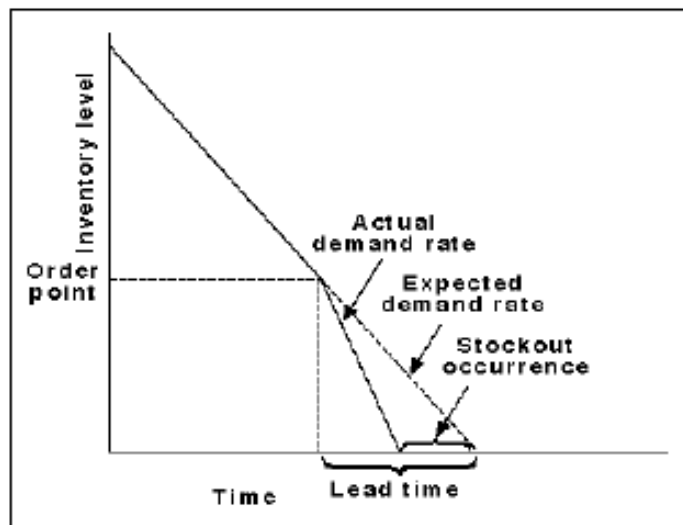
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However, in cases of uncertainty in Lead time analysis there can be situation when the stock out may occur, if there is delay in replenishing of the order. In such case, the inventory level will go beyond the minimum level of inventory.

In order to handle such situations, the company usually keeps certain contingent or buffer stock to handle such stock out situation, and this buffer is usually called as *Safety Stock*.

Safety Stock
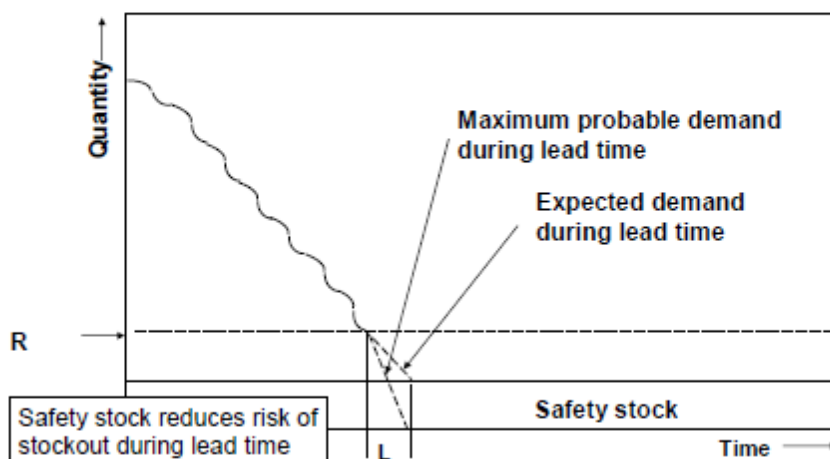
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Inventory Level with Safety Stock