Inventory Model →

The word inventory refers to any kind of resources having economic value & is maintained to fulfil present & future needs of an organization.

Inventory is an idle resource of any kind provided such a resource an economic value.

- Manufacting units :- raw meterial, manpower, finished Products, machine
- Hospitals : Stock of drugs, medicines, equipments
- Bank : money, machines.
- Airline : fuel, Specilized person, equipments.

Inventory of resources is held to provide desireabe service to customers & to achieve sells turn over target.

Reasons for maintaining inventories

i) It helps in smoth functioning & efficient running of the business.

ii) It provides adiquate services to the customers

iii) It reduces possibility of duplicates of order,

iv) It helps in maintaining a balance in the

economy by absorbing some of the fluctuat
when the demand of an item fluctuate
or is seasonal in nature

vi) It helps in minimizing the losses due to deteriat^n, damage etc

vii) It acts as a buffer stock when raw materials are received late & shop reserctions are too many.

viii) Takes advantages of price discounts by bulk Purchases.

Meaning of inventory control :

(a) what item should be stocked ?

(b) { Holding of stock is expensive, so controls are needed to ensure that stock level remains optimum.

(i) stock of existing items is kept at reasonable levels.

(ii) Unnessary items are not added to the inventory

(iii) All items which are no longers used are removed from the inventory

(iv) Stock should be controled using rational Policies to balance b/w holding west & demand i.e, comparison should

ade b/w cost & benifits of holding

(c) How much should be ordered in each replenishment.

→ Every time an order is placed there are certain costs incurred on account of administration, transportation, inspecn etc. If large, frequent orders are placed the costs of ordering and delivery are kept low, but stock levels & avg inventory value are high. If small frequent orders are placed, the cost of ordering & delivery are high, but avg stock level is low. Thus need is to trade off these two options to minimize the overall total cost. Various types of inventory costs will be discussed later in this chapter. However order quantity normally depends on —

(i) Demand Pattern

(ii) Price of an item including discounts for larger orders, & impending price rise etc.

(iii) Lead time

(iv) various inventory costs

Types of inventory

(a) transportation inventories: They arise due to transportation of inventory items to the various distribution centres & customers from the various Producn centres. The amount of transportation inventory depends on the time consumed in transportation & the nature of the demand.

(b) buffer inventories: These are maintained to meet the uncertainties of demand & supply.

(c) Anticipation inventories: These are built in advance by anticipating or foreseeing the future demand. For example, Produc^n of crackers before the diwali ~~feb~~ festival; electric fans or coolers before the onset of the summer season.

(d) Decoupling inventories: The inventories used to reduce the interdependence of the various stages of a Produc^n system are known as decoupling inventories.

(e) Lot-size inventories: Generally, the rate of consumption is different from the rate of production or purchasing. Therefore, the items are produced in largers quantities, which result in lot size, also known as cycle inventories.

Inventory Costs

(a) Item Cost: It refers to the cost associated with an item, whether it is manufactured or purchased. The purchase price will be considered when discounts are allowed for any purchased above a certain quantity.

(b) Set-up cost (C_3): These costs include the fixed cost associated with obtaining the

goods through placing of an order and purchasing, manufacturing or setting up a machinery before starting the Product. They include the costs of — Purchase, requisition, follow-up, receiving the goods, quality control etc. These are also called order costs or replacement costs; usually denoted by C_3, Per production cycle. They are assumed to be independent of the quantity ordered or produced.

(c) Carrying or holding cost (C_1): The cost associated with carrying or holding the goods in stock is known as holding or carrying cost, which is denoted by C_1, per unit of goods for a unit of time. Holding cost is assumed to vary directly with the size of inventory as well as the time for which the item is held in stock. The following components constitute the holding cost.

(i) Invested capital cost: This is the interest charged over the capital invested.

(ii) Record keeping & administrative cost.

(iii) Handling cost: These include the costs associated with the movement of stock such as cost labour.

(iv) Storage costs.

(v) Depreciation costs.

(vi) Taxes & insurance

If P is the Purchase price & I is the stock holding cost per unit per unit holding cost

$C_1 = IP$

(d) Shortage cost or stock out cost (C_2): The penalty costs that are incurred as a running out out of stock are known as shortage or stock out costs.

Lead time: The time gap b/w the placing of an order & the actual arrival of the inventory. We generally consider it as 0.

Deterministic Inventory Control

There are 4 different Parts —

i) Purchasing Model with no shortage

ii) Manufacturing " " " "

iii) Purchasing " " shortage

iv) Manufacturing " " "

EOQ Model without shortage :

{EOQ → Economic order quantity}

(i) Purchasing Model with no shortage :-

The economic lot size with uniform demand.

In this model we have to derive an economic lot size formula for the optimum Product quantity (q) per cycle of a single Product so as to minimize the total avg variable cost for unit time.

assumption

(i) demand rate is uniform

(ii) lead time is zero.

(iii) Product rate is infinite

(iv) shortages are not allowed

(v) holding cost is rs C_1 per quantity unit per unit time

(vi) Set up cost is Rs. C_3 per ~~time~~ setup

The optimum quantity to be Produced (or Order) at each time interval t is —

$$q^* = \sqrt{\frac{2C_3R}{C_1}}$$

Minimum cost is denoted by

$$C^* = \sqrt{2C_1C_3R}$$

Optimum no. of ~~years~~ orders placed per year

$$n^* = R/q^*$$

$$= \sqrt{\frac{RC_1}{2C_3}}$$

optimum length b/w orders

$$t^* = \sqrt{\frac{2C_3}{RC_1}} = \frac{1}{n^*}$$

Minimum total annual inventory cost

The annual demand of an item is 3200 units. The unit cost is Rs. 6. 4 inventory carrying cost 25% per annum. If the cost of one Procurment is 150/-. Find (i) EOQ. ii) No of orders per years (iii) time b/w two orders (iv) the optimal cost.

→ $R = 3200$ units

$C_1 = C \cdot i$ $\quad C = 6$

$i = \frac{25}{100} = 1/4$

$\therefore C_1 = 6 \times 1/4 = 1.5$

$C_3 = 150$

$$EOQ = q^* = \sqrt{\frac{2C_3 R}{C_1}} = 800$$

No of orders per per years $= n^* = \frac{R}{q^*} = 4$

Time b/w two orders $= t^* = \sqrt{\frac{2C_3}{RC_1}} = \frac{1}{n^*} = 0.25$ yrs

$= 3$ months

~~The optimal cost~~ $C^* = \sqrt{2C_1 C_3 R} = 1200$

Optimum cost $= C \times R + \sqrt{2C_3 C_1 R} = 20400$

Q> A company purchases 9000 parts of a machine for its annual requirements, ordering one months users at a time each part cost Rs 20, the ordering cost for order Rs 15. and carrying charges are 15% of the avg inventory per year, you have been asked to suggest a more economical purchasing policy. what would advise would you offer & how much it save the company per year.

→ $R = 9000$

$C_1 = 20 \times \frac{15}{100} = 3$

$C = 20$

$i = \frac{15}{100}$

$C_3 = 15$

$C_2 = 0$

$q^* = 300$

$t^* = n^* = 30$

$t^* = 0.03$ yrs $= 12$ days

$t^* = \sqrt{2 \times C_1 C_3 R} = \sqrt{2 \times 3 \times 15 \times 9000}$

$= 900$

- If the company follows the policy of ordering every month then annual ordering cost is $12 \times 15 = 180$ rs.

- Lot size of the inventory for each month is $q = \frac{9000}{12} = 750$ Parts

- Avg inventory at any time $= \frac{q}{2} = \frac{750}{2} = 375$ (divided by 2 order one unit)

→ Storage cost at any time $375 \times C_1 = 375 \times 3 = 1125$

→ Total cost $= 180 + 1125 = 1305$

→ If the company purchases 3000 (q^*) Parts at time interval of 12 days (t^*) instead of ordering 750 Parts each month there will be neat saving of $1305 - 900 = 405$ rs

Q. the demand rate of a particular item is 12000 units per year. The set up cost per run

(2) Manufacturing model with no shortage

9 A contractor has to supply 10,000 bearings/day to an automobile manufacturer. He finds that when he starts production run, he can produce 25,000 bearings/day. The holding cost of a bearing in stock is ₹0.02/year. Set up cost of a production is ₹18. How frequently should the production run be made

$K = 25,000$ $\quad R = 10,000$

$C_1 = 0.02$ /year $\quad C_3 = 18$

$= (0.02 \div 365)$/days

$= 0.0000547945$ / day

$$q^* = \sqrt{\frac{2C_3R}{C_1}} \times \sqrt{\frac{K}{K-R}}$$

$$= \sqrt{\frac{2 \times 18 \times 10000}{0.0000547945}} \times \sqrt{\frac{25000}{25000-10000}}$$

$$= 10447$$