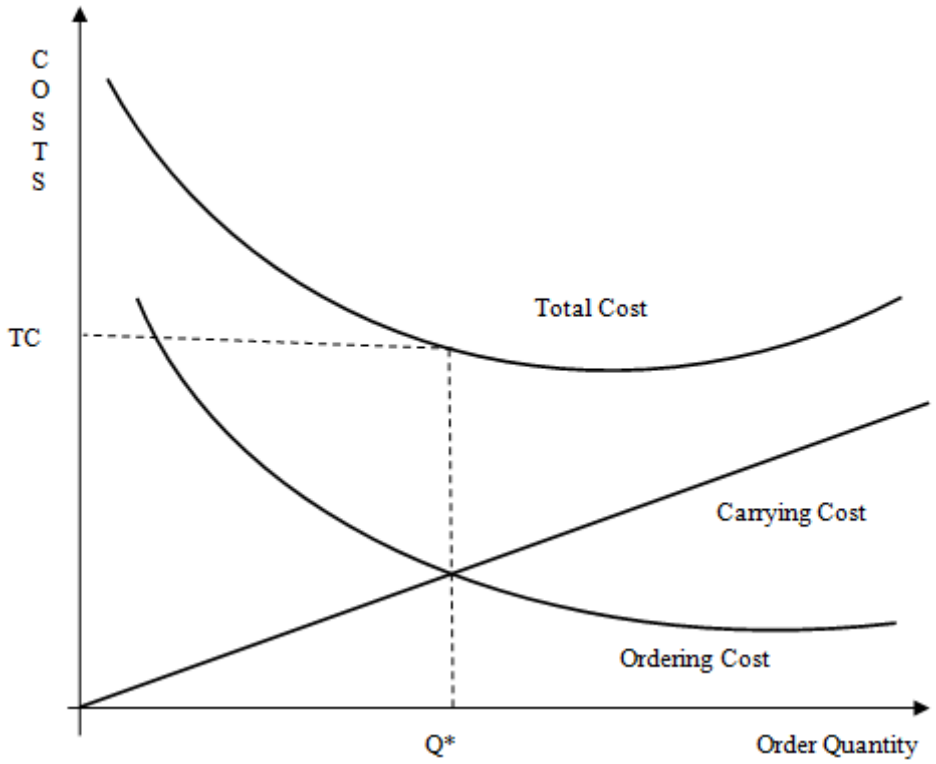
OPERATIONAL RESEARCH
(INVENTORY MODEL)

Introduction

- Inventory (previously called Stock) is substantial to provide flexibility in operating an entity or a corporate structure.
- An inventory is processed through 3 stages: raw materials, work in process (WIP) and finished goods.
- The inventory at the raw material stage eradicates dependency between the factory and suppliers.
- The work-in process inventory eradicates dependency between multiple machinery of a product line.
- The finished goods inventory eradicates dependency between the factory and the market, i.e. its clients.
- The primary purpose of an inventory is to **regulate its supply, minimise the production cost and assist entities to handle the flow of their perishable items.**

Cost Trade Off

- If the order is placed on a frequent basis, the ordering costs will hike however the inventory carrying cost will lessen.
- Contrarily, should we order rarely, the ordering cost will diminish unlike the carrying cost which will increase.



Inventory Decisions

- The management is responsible to make decisions with respect to:
  - When is the appropriate time to replenish the inventory of an item?
  - How much replenishment is required for the inventory?

Cost of inventory systems

- The inventory systems comprises of the hereunder costs:
  - Purchase price/unit
  - Ordering cost/order
  - Carrying cost/unit/period
  - Shortage cost/unit/period

Inventory Models

- There are different types of inventory models which can be classified into deterministic and probabilistic models respectively.

- The multiple basic deterministic models are:
  - Purchase model with instantaneous replenishment and without shortages
  - Manufacturing model without shortages
  - Purchase model with instantaneous replenishment and with shortages
  - Manufacturing model with shortages

Purchase model with instantaneous replenishment and without shortages

- This inventory model consists of equal sized orders placed at periodical intervals.
- The items are replenished instantaneously against an order and the items are exhausted at a constant rate.
- The purchase price per unit is invariable irrespective of order size.

EXAMPLE 1

Mr Rajiv needs 1400 units/year of a bought out component which will be used in its main product for his factory. The ordering cost is Rs150 per order and the carrying cost per unit per year is Rs 20.

Find the economic order quantity (EOQ), the number of orders per year and the time between successive orders.

Purchase model with instantaneous replenishment and with shortages

- In this model, the product will be received immediately upon order and it is consumed at a constant rate.
- The purchase price per unit is constant irrespective of order size.
- If there is no inventory at the time of receiving an order for the product, it is assumed that the order will be fulfilled at a later date subject to a penalty. This is also known as backordering.

Manufacturing Model without shortages

- Should the entity manufacture a product which will supplement its main product, the corresponding model of inventory would be called Manufacturing Model.
- In this model, shortages are not allowed.
- The rate of consumption of the item is assumed to remain constant throughout the year.
- The item is produced and consumed at the same time for a portion of the cycle time.
- During the remaining cycle time, the product is only consumed.
- The cost of production per unit remains uniform irrespective of the production lot size.

EXAMPLE 1

- The annual demand for a component is 17200 units. The carrying cost is Rs 1500/unit/year, the ordering cost is Rs. 1500 per order and the shortage cost is Rs. 2000/unit/year. Find the optimal values of economic order quantity, maximum inventory, maximum shortage quantity, cycle time (t), inventory period (t_1) and shortage period (t_2).

Other Inventory Models

- Models with Price-breaks
  - Model with single price-break.
  - Model with a number of price-breaks.

- Models with Restrictions or Multi-item Deterministic Model with one linear constraint
  - Restriction of availability of Capital
  - Limitation or restriction of floor space
  - Limitation or restriction of a number of Units

- Replenishment Systems (Inventory Control Systems)
  - Fixed order quantity system
  - Fixed interval system

Other Inventory Models

- Probabilistics Models or Stochastic Models
  - Instantaneous Demand (Discrete demand) without set up cost.
  - Instantaneous Demand (Continuous demand) without set up cost.

- Selective Control or Inventory Control
  - ABC Analysis (Classification of items into 3 categories, A, B and C in descending order of annual consumption value)
  - VED (Vital, Essential. Desirable items) Analysis
  - FSND (Fast moving items, Slow Moving Items, Normal moving items, Dead Lock) Analysis

Tutorial 1

- Alpha Industry needs 25,000 units per year of a bought out component which will be used in its main product. The ordering cost is Rs325 per order and the carrying cost per unit per year is 30% of the purchase price per unit. The purchase price per unit is Rs55. Find the economic order quantity, number of orders per year and the time between successive orders.

- The annual demand of an item in the stores of a factory is 19000 units. Its annual carrying cost is 25% of the purchase price of the item, where the purchase price is Rs30 per unit. The ordering cost is Rs35 per order. Presently, the order size of the item is the average monthly demand of that item. Find the economic order quantity and compare its cost with the present ordering system. Find the corresponding cost advantage if exists.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