Operations & Supply Planning
PGDM 2018-20

Inventory Management

Vinay Kumar Kalakbandi
Assistant Professor
Operations Management

Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

Why inventories?

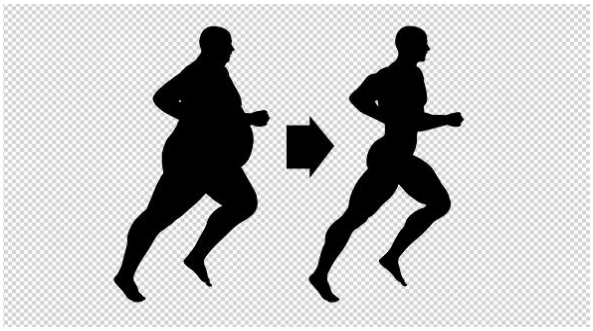
- Economies of Scale
- Supply and Demand Uncertainty
- Volume Discounts/Impending Price Rise
- Long Lead Times and Quick Response to Customer's Demand
- To maintain independence of operations
- To allow flexibility in production scheduling

Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

Inventory

Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

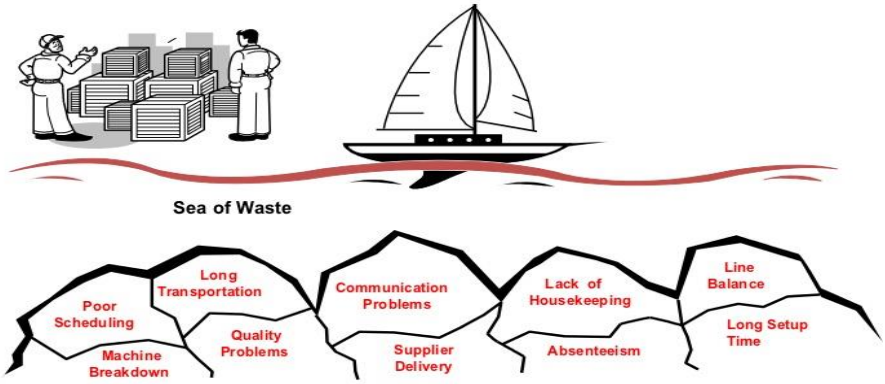
Inventory is injurious to your health!



Get Lean...Get healthy!

Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

Inventory Hides Problems



40

Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

We want to turn our inventory faster than our people

- A quote by James D. Sinegal
  - Co-founder, Costco

Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

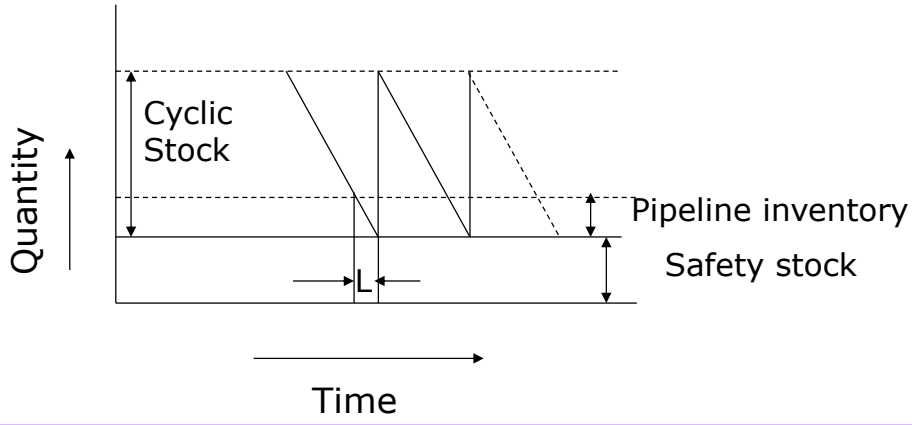
Inventory classification

- Classification by form
  - Raw Materials (RM)
  - Work-in-Process (WIP)
  - Finished Goods (FG)
- Classification by Life cycle
  - Perishable
  - Non-perishable

Inventory classification by function

- Cyclic stock
  - Ordering lot size/2
- Safety stock
  - To protect against uncertainties
- Anticipation
  - To absorb uneven rates of demand or supply
- Pipeline
  - Scheduled receipts or open orders

Cyclic, Pipeline and Safety Stocks



Cyclic inventory, pipeline inventory and safety stocks are critically linked to "how much" and "when" decisions in inventory planning

"I guess smaller, more frequent deliveries are out of the question?"

Costs of Inventory

- Physical holding cost (*out-of-pocket*)
- Financial holding cost (*opportunity cost*)

- Holding (or carrying) costs

- Transportation cost
- Ordering costs

- Fixed costs

- Low responsiveness
  - to demand/market changes
  - to supply/quality changes

- Shortage costs

- Obsolescence

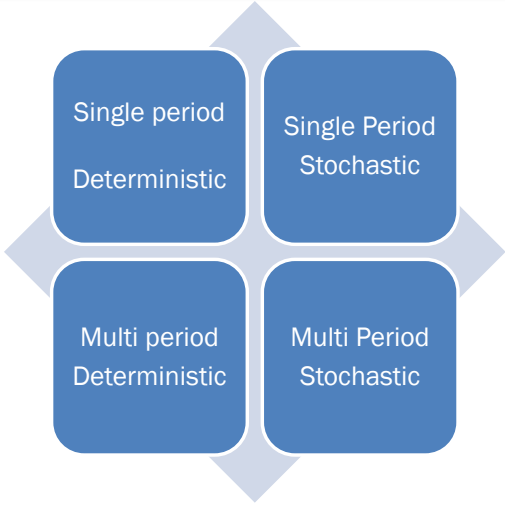
- Inventory writedown

Inventory Policy parameters

- **WHEN to order?**
- **HOW MUCH to order?**

- In WHAT FORM? *(RM, WIP or FG)*
- WHERE TO DEPLOY in the supply chain?

Types of inventory models



Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

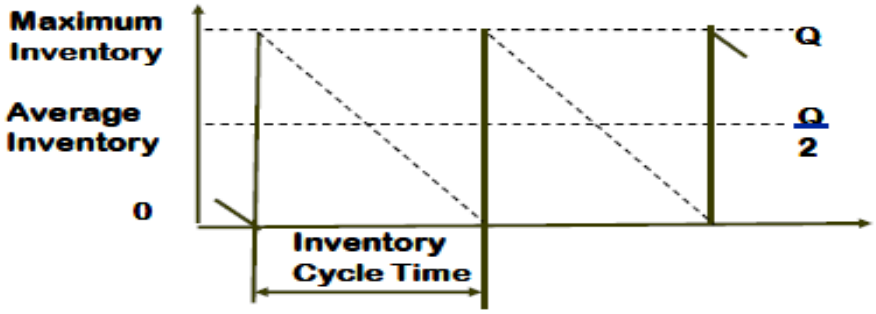
Single Period Deterministic

- You have to make a decision on how much to inventory in every period
- You know how much the demand for the period is going to be
- What do you do?

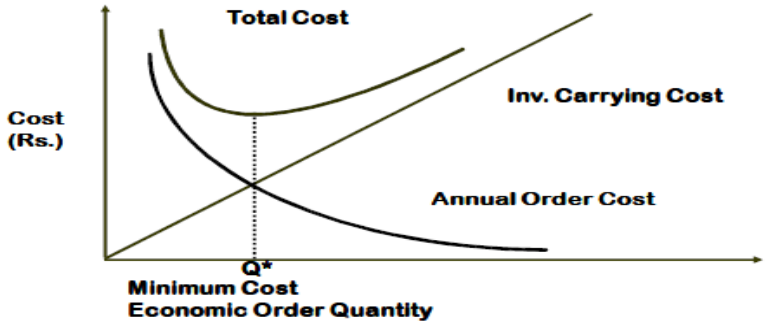
Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

Multi Period Deterministic

- Perpetual inventory system
- Demand for the product is known constant and uniform throughout the period
- Lead time (time from ordering to receipt) is constant
- Replenishment is instantaneous
- Price per unit of product is constant
- Inventory holding cost is based on average inventory
- Ordering or setup costs are constant
- All demands for the product will be satisfied (no back orders are allowed)
- How would the inventory level look like?



- What should be the ordering quantity (Q)?



Tradeoffs: Inventory Carrying versus Annual Ordering Costs

$$TC(Q) = \frac{D}{Q}S + \frac{Q}{2}H$$

Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

EOQ model

D: Demand per year
S: Setup or Order Cost (Rs/Setup; Rs/Order)
c= unit cost of item
h = Inv holding cost rate
$H=hc$: Inventory holding cost (Rs./year/unit)
Q: Order quantity
T: Reorder cycle

$$Q^* = \sqrt{\frac{2DS}{H}}$$

$$T = \frac{Q^*}{D} = \sqrt{\frac{2S}{DH}}$$

$$TC(Q^*) = \sqrt{2SDH}$$

Institute of Management Technology Hyderabad
...Harnessing Knowledge for Businesses

Inventory Planning Models

Mean of weekly demand	: 200
Standard deviation of weekly demand	: 40
Unit cost of the raw material	: Rs. 300/-
Ordering cost	: Rs. 460/- per order
Carrying cost percentage	: 20% per annum
Lead time for procurement	: 2 weeks

EOQ Model

Weekly demand = 200

Number of weeks per year = 52

Annual demand, D = 200*52 = 10,400

Carrying cost, C_c = Rs. 60.00 per unit per year

Economic Order Quantity = $\sqrt{\frac{2DS}{H}} = \sqrt{\frac{2*460*10,400}{60}} = 399.33 \approx 400$

Time between orders = $\frac{400}{10400} = \frac{2}{52} = 2\,weeks$

Institute of Management Technology Hyderabad

...Harnessing Knowledge for Businesses