Inventory Management

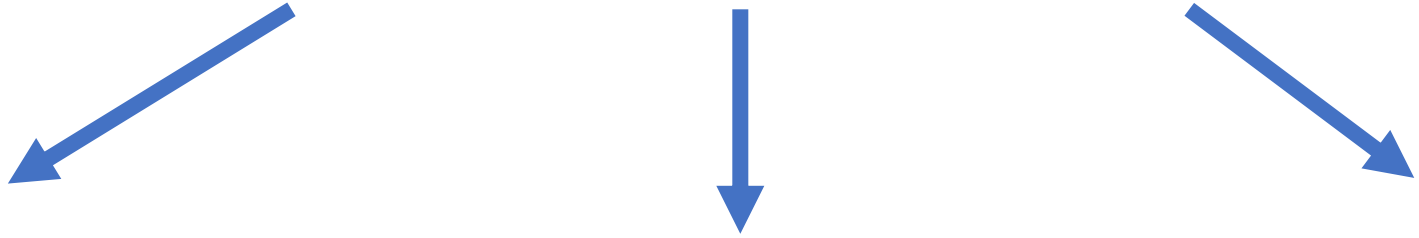
Meeting 6

- 1. Explain the terms inventory and inventory management.
- 2. Determination of investment in inventory.
- 3. Costs in inventory.
- 4. Calculate the optimal order quantity (EOQ / Economic Order Quantity)
- 5. Inventory control system using ABC method, just in time, & computer control system.

Inventory management

- The firm's **financial manager** must arrange the firm's inventory policy and ensure the **firm's overall profitability**.
- Therefore, the role of the **inventory manager** is to **balance the costs and benefits** associated with inventory.
- Because **excessive inventory uses cash**, **efficient management of inventory increases firm value**.

Types of inventories



Raw materials	**Work-in process**	**Finished goods**
To make the final product	Intermediate stage of production	Goods ready to sale
purchasing and production executives	production executives	production and marketing executives

Types of inventories

- **Raw materials** are materials and components that are inputs in making the final product.

- **Work-in process**, also called stock-in-process, refers to goods in the intermediate stages of production.

- **Finished goods** consist of final products that are ready for sale. While manufacturing firms generally hold all the three types of inventories, distribution firms hold mostly finished goods.

Inventory management

- Inventories represent the second largest asset category for manufacturing companies, next only to plant and equipment.

- **The proportion of inventories to total assets** generally varies between 15 and 30%.

Inventory management

- Decisions relating to inventories are taken primarily by **executives in production, purchasing, and marketing departments.**
- **Raw material** policies are shaped by purchasing and production executives
- **Work-in-process** inventory is influenced by the decisions of production executives
- **Finished goods** inventory policy is evolved by production and marketing executives
- Yet, as inventory management has important financial implications, the **financial manager has the responsibility to ensure that inventories are properly monitored and controlled**.

Benefits of Holding Inventory

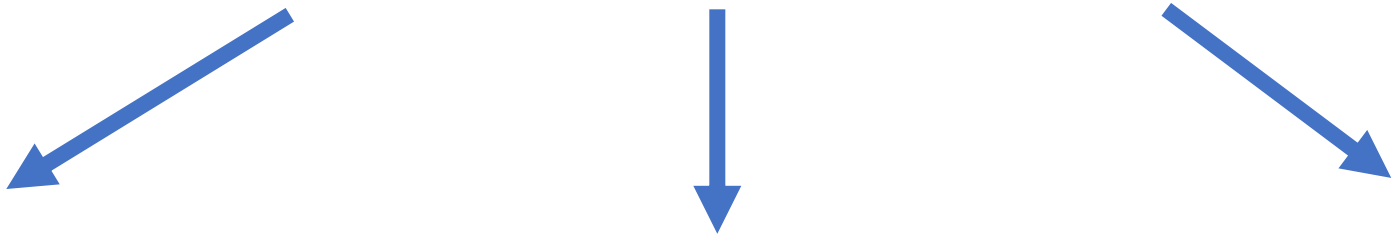
- A firm needs its inventory to operate for several reasons.
- First, inventory helps minimize the risk that the firm will not be able to obtain an **input it needs for production**.
- If a firm holds too little inventory (or stock-outs), it will lead to **lost sales**. Disappointed customers may switch to one of the firm's competitors.
- Second, firms may hold inventory because factors such **as seasonality in demand** mean that customer purchases do not perfectly match the most efficient production cycle.

Benefits of Holding enough Inventory

Inventory ↓ - production ↓ - goods ↓ - sales ↓ - profit↓

too little

Costs of Inventory



Ordering costs

e.g. expediting, transport

Carrying (holding) costs

e.g. storage, insurance, taxes

Shortage costs

e.g. safety stock

Ordering costs

- Ordering costs relating to purchased items would include expenses on the following: requisitioning, preparation of purchase order, expediting, transport, and receiving and placing in storage.
- Ordering costs pertaining to items manufactured in the company would include expenses on the following: requisitioning, set-up, and receiving and placing in storage.

Carrying costs

- Carrying costs include expenses on the following: interest on capital locked up in inventory, storage, insurance, and obsolescence.
- Carrying costs generally are about 25 percent of the value of inventories held.

Shortage costs

- Shortage costs arise when inventories are short of requirement for meeting the needs of production or the demand of customers.
- Inventory shortages may result in one or more of the following: high costs concomitant with 'crash' procurement, less efficient and uneconomic production schedules, and customer dissatisfaction and loss of sales.
- Measurement of shortage costs when shortage results in failure to meet customer demand is relatively difficult because the effects are both long-term and short-term and somewhat intangible in nature.
- When a firm orders large quantities, in a bid to reduce the total ordering costs, the average inventory, other things being equal, tends to be high thereby increasing the carrying costs.
- Also, when a firm carries a large safety stock to reduce shortage costs its carrying costs tend to be high. In view of such relationships, minimisation of overall costs of inventory management would require a consideration of trade-offs among these costs.

Costs of Holding Inventory – GAP example

- The benefits from reducing inventory requirements can be substantial.
- In 2003, the apparel chain GAP reduced its investment in inventory significantly by reducing its inventory days outstanding by 24%.
- This change gave $344 million for other purposes.
- GAP invested some of this cash in short-term securities—primarily in U.S. government and agency securities and in bank certificates of deposits with maturities between three months and one year.
- The firm reported an increase of $1.2 million in interest income in fiscal year 2003 compared with fiscal year 2002.
- It attributed the increase to increases in the average cash balances available for investment

Benefits from reducing inventory

Inventory ↓ - free cash ↑ - investment ↑ - interest income ↑ - profit ↑

reducing investment

Costs of Holding Inventory - just-in-time inventory management

- Some firms seek to reduce their carrying costs as much as possible.
- With “just-in-time” (JIT) inventory management, a firm acquires inventory precisely when needed so that its **inventory balance is always zero, or very close to it.**

- This technique requires:
- **1. exceptional coordination with suppliers**
- **2. predictable demand for the firm’s products**
- **3. good production planning is also essential**

Just-in-Time Inventory

- **The approach began in Japan**, and it is a fundamental part of Japanese manufacturing philosophy. The goal of JIT is **to have only enough inventory to meet immediate production needs.**
- The result of the JIT system is that **inventories are reordered and restocked** frequently. Making such a system work and avoiding shortages requires a high degree of cooperation among suppliers.
- **Japanese manufacturers** often have a relatively **small**, tightly integrated **group of suppliers** with whom they work closely to achieve the needed coordination.
- These suppliers are a part of a **large manufacturer's (such as Toyota's) industrial group, or keiretsu.** Each large manufacturer tends to have its own keiretsu. It also helps to have suppliers located nearby, a situation that is common in Japan.

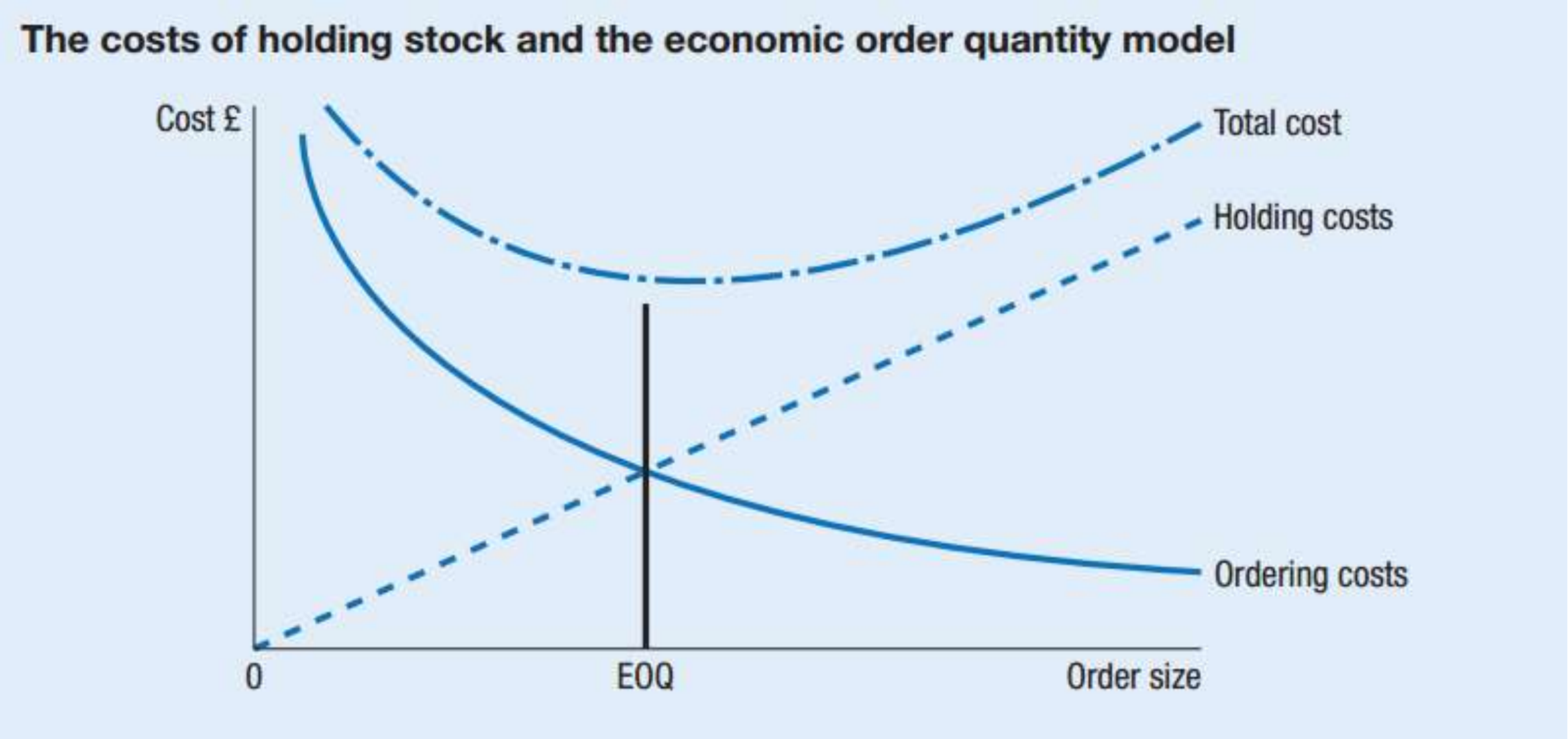
The economic order quantity

- This classical stock management model calculates an **optimum order size** by balancing the **costs of holding stock against the costs of ordering fresh supplies**.

- This optimum order size is the basis of a minimum cost policy.

- The economic order quantity model assumes that, for the period under consideration (usually one year), **costs and demand are constant** and known with certainty.

The economic order quantity



The economic order quantity

Total annual cost = Annual holding cost + Annual ordering cost

Algebraically:

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

where: Q = order quantity in units
H = holding cost per unit per year
S = annual demand in units per year
F = ordering cost per order

The annual holding cost is the average stock level in units ($Q/2$) multiplied by the holding cost per unit per year (H). The annual ordering cost is the number of orders per year (S/Q) multiplied by the ordering cost per order (F).

The economic order quantity model – British version

- The minimum total cost occurs when holding costs and ordering costs are equal
- Q is the economic order **minimises the sum of holding costs and ordering costs** quantity, i.e. the order quantity which

$$Q = \sqrt{\frac{2 \times S \times F}{H}}$$

where: Q = order quantity in units
H = holding cost per unit per year
S = annual demand in units per year
F = ordering cost per order

Using the EOQ model

Oleum plc sells a soap called Fragro, which it buys in boxes of 1000 bars with ordering costs of £5 per order. Retail sales are 200 000 bars per year and holding costs are £2.22 per year per 1000 bars. What is the economic order quantity and average stock level for Fragro?

Suggested answer

$$F = £5 \text{ per order}$$
$$S = 200\,000 \text{ bars per year}$$
$$H = £2.22 \text{ per } 1000 \text{ bars}$$

so:

$$Q = (2 \times 200\,000 \times 5/(2.22/1000))^{1/2}$$
$$= 30\,015 \text{ bars, or approximately } 30 \text{ boxes}$$

The average stock level = $Q/2 = 30\,000/2 = 15\,000$ bars.

The economic order quantity model - American version

The EOQ Based on our previous two examples, what size orders should Thiewes place to minimize costs? How often will Thiewes restock? What are the total carrying and restocking costs? The total costs?

We know that the total number of pairs of boots ordered for the year (T) is 600. The restocking cost (F) is \$20 per order, and the carrying cost (CC) is \$3 per unit per year. We can calculate the EOQ for Thiewes as follows:

$$\begin{aligned} \text{EOQ} &= \sqrt{\frac{2T \times F}{\text{CC}}} \\ &= \sqrt{\frac{(2 \times 600) \times \$20}{3}} \\ &= \sqrt{8{,}000} \\ &= 89.44 \text{ units} \end{aligned}$$

Because Thiewes sells 600 pairs per year, it will restock 600/89.44 = 6.71 times. The total restocking costs will be \$20 × 6.71 = \$134.16. Average inventory will be 89.44/2 = 44.72. The carrying costs

The economic order quantity model - Indian version

- For determining the EOQ formula we shall use the following symbols:
- U = annual usage/demand
- Q = quantity ordered
- F = cost per order
- C = percent carrying cost
- P = price per unit
- TC = total costs of ordering and carrying

$$TC = \frac{U}{Q} \times F + \frac{Q}{2} \times P \times C$$

$$Q = \sqrt{\frac{2FU}{PC}}$$

Example

The EOQ model may be illustrated with the help of the following data relating to Ace Company.

U = annual sales = 20,000 units
F = fixed cost per order = Rs.2,000
P = purchase price per unit = Rs.12
C = carrying cost = 25 percent of inventory value.

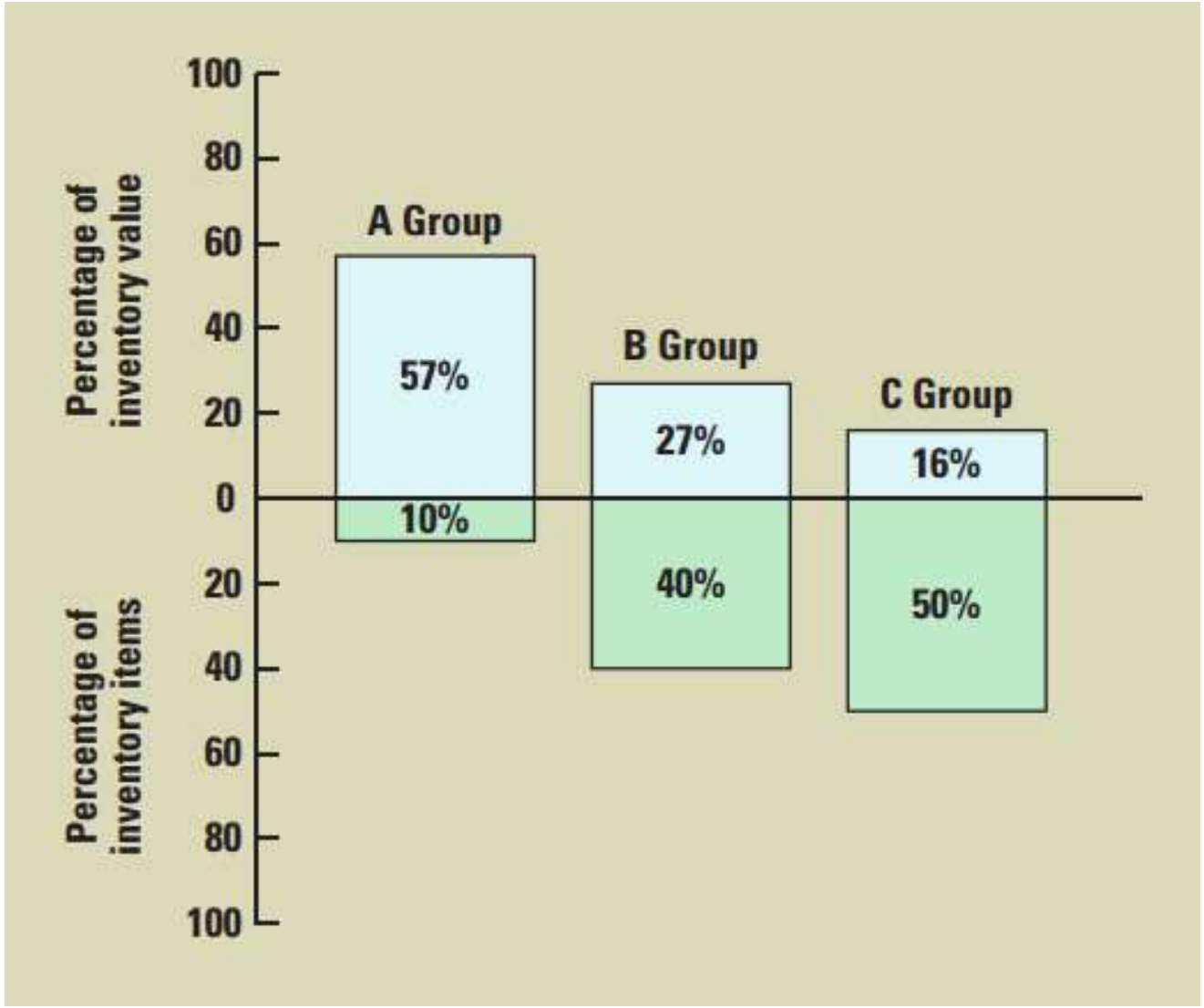
Plugging in these values in Eq. (26.2), we get

$$Q = \sqrt{\frac{2 \times 2,000 \times 20,000}{12 \times 0.25}} = 5,164$$

Inventory Management Techniques – THE ABC APPROACH

- The ABC approach is a simple approach to inventory management in which the basic idea is to **divide inventory into three (or more) groups.**
- The underlying rationale is that **a small portion of inventory in terms of quantity might represent a large portion in terms of inventory value**.
- For example, this situation would exist for a manufacturer that uses some relatively expensive, high-tech components and some relatively inexpensive basic materials in producing its products.

Inventory Management Techniques – THE ABC APPROACH



THE ABC APPROACH

- Figure illustrates an ABC comparison of items in terms of the percentage of inventory value represented by each group versus the percentage of items represented.
- As Figure shows, the A Group constitutes only 10 percent of inventory by item count, but it represents more than half of the value of inventory.
- The A Group items are thus monitored closely, and inventory levels are kept relatively low.
- At the other end, basic inventory items, such as nuts and bolts, also exist; but, because these are crucial and inexpensive, large quantities are ordered and kept on hand. These would be C Group items.
- The B Group is made up of in-between items.