

# **STRATEGIC LOGISTICS MANAGEMENT**



## **CHAPTER 5: INVENTORY MANAGEMENT**



# LEARNING OUTCOMES

At the end of this unit students should be able to:

- Explain why firms need inventory
- Describe and distinguish between the common types of inventory
- Discuss and apply the reasons firms hold inventory
- Discuss and distinguish between the different inventory-related costs
- Discuss the different types of demand
- Undertake qualitative and quantitative forecasting in inventory
- Perform an ABC (Pareto) analysis



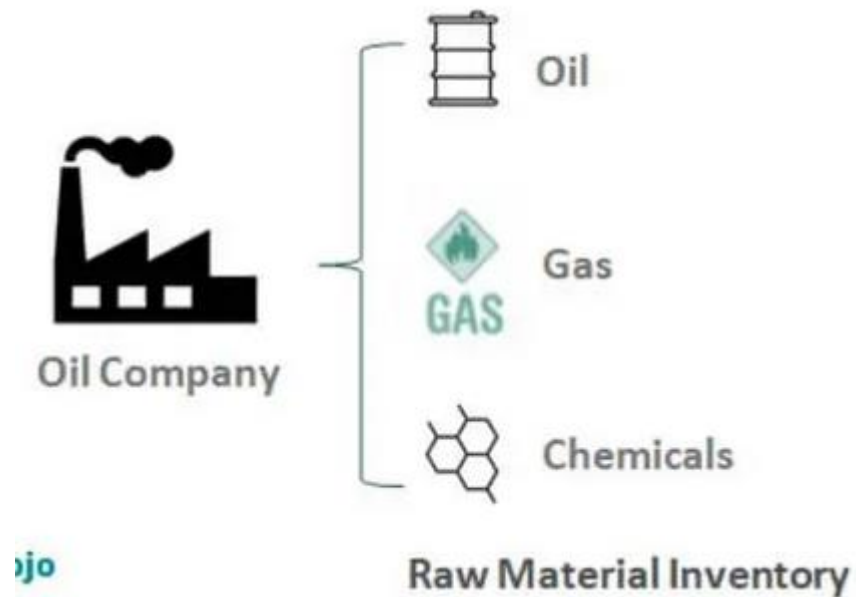
# DEFINING INVENTORY

Typically includes:

- **Raw materials:** that are being stored while awaiting utilization/consumption in the process of making a finished product
- **Work-in-progress items:** items that are stored while waiting to be worked on during the next sequential task in the manufacturing process
- **Parts/equipment:** that are stored in readiness for utilization in maintenance, repair or operations tasks
- **Finished items:** that are kept in stock in order to be able to satisfy customers' demands when they arise

# DEFINING INVENTORY

**Raw materials:** that are being stored while awaiting utilization/consumption in the process of making a finished product



## Clothing manufacturer



# DEFINING INVENTORY

**Work-in-progress items:** items that are stored while waiting to be worked on during the next sequential task in the manufacturing process



# DEFINING INVENTORY

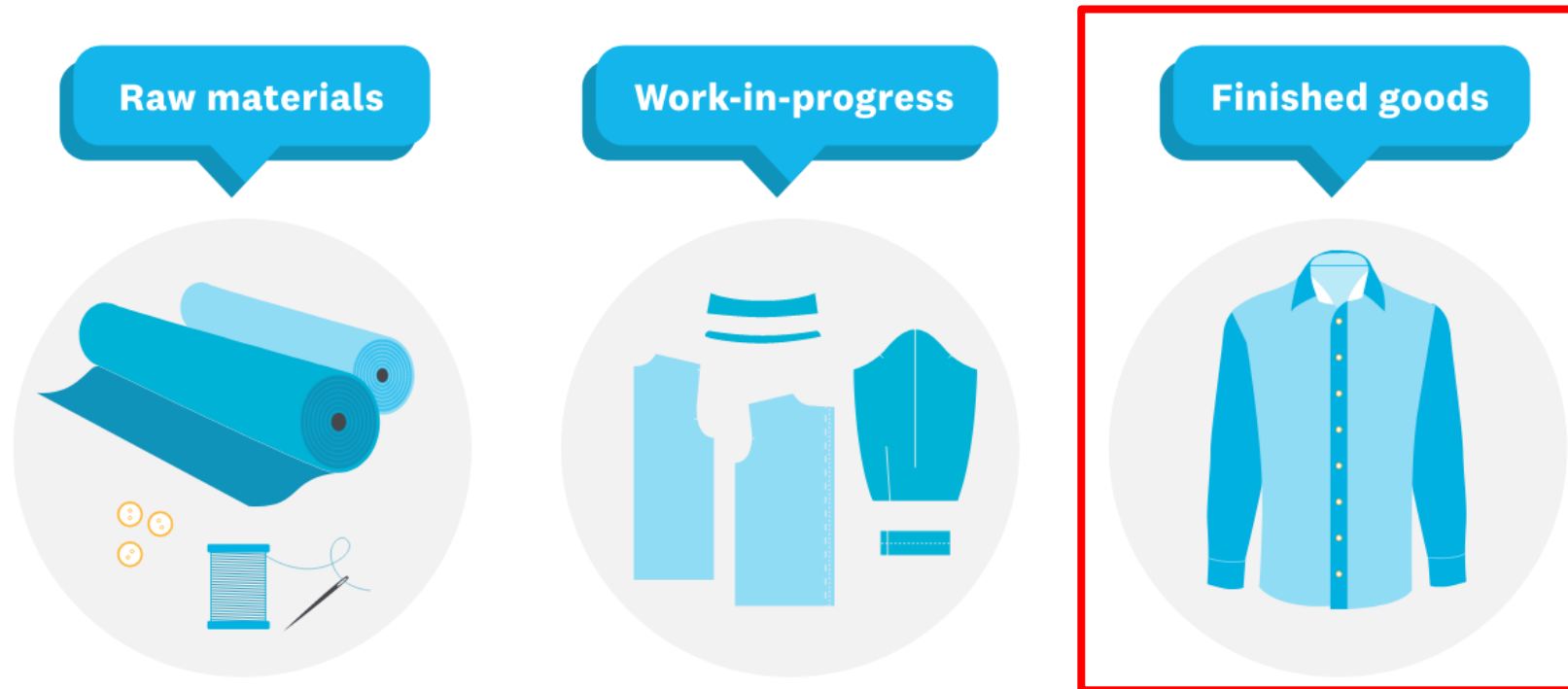
**Parts/equipment:** that are stored in readiness for utilization in maintenance, repair or operations tasks





# DEFINING INVENTORY

**Finished items:** that are kept in stock in order to be able to satisfy customers' demands when they arise





# COMMON TYPES OF INVENTORY

Categories of inventory:

1. **Cycle stock:** the portion of inventory that is carried specifically for the purposes of satisfying regular orders
2. **Safety stock:** portion of inventory items held as a buffer to enable the organization to cushion the effects of uncertainties in demand and/or supply
3. **Anticipation stock:** companies carry because of the high likelihood of occurrence of a future event, which justifies stocking quantities of the item above regular cycle quantities
4. **Seasonal stock:** items that are carried in store simply because of the levels of demand peculiar to particular periods of the year can be categorized as seasonal stock
5. **Promotional stock:** carried so that high levels of demand due to a promotion campaign can be satisfied
6. **Deadstock:** stock that an organization may have but cannot utilize as was intended
7. **Non-conformance stock:** Similar to deadstock. The difference is that they can be utilized by other parties



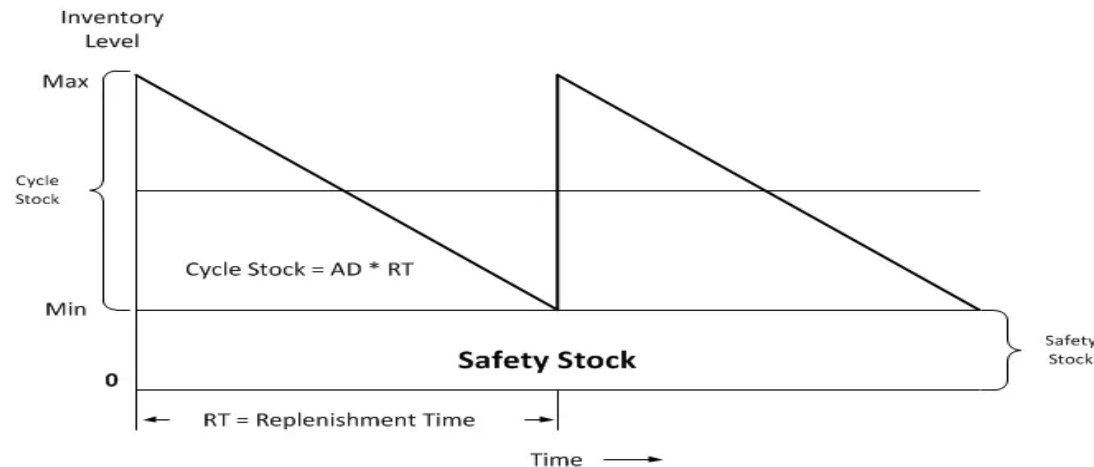


# COMMON TYPES OF INVENTORY

**1. Cycle stock:** the portion of inventory that is carried specifically for the purposes of **satisfying regular orders**

- **Manufacturing:** production items
- **Sales:** items to satisfy sales orders

**2. Safety stock:** portion of inventory items held as a buffer to enable the organization to cushion the effects of uncertainties in demand and/or supply



# COMMON TYPES OF INVENTORY

**3. Anticipation stock:** companies carry because of the high likelihood of occurrence of a future event, which justifies stocking quantities of the item above regular cycle quantities

## Examples:

- Price increases
- Strikes
- Upcoming maintenance



# COMMON TYPES OF INVENTORY

**4. Seasonal stock:** items that are carried in store simply because of the levels of demand peculiar to particular periods of the year can be categorized as seasonal stock

- Seasonal stock vs. anticipation stock



HERS





# COMMON TYPES OF INVENTORY

**5. Promotional stock:** carried so that high levels of demand due to a promotion campaign can be satisfied



# COMMON TYPES OF INVENTORY

**6. Deadstock:** stock that an organization may have but cannot utilize as was intended

- Kept too long in storage
- Expired
- Outdated
- Recall: listeriosis



# COMMON TYPES OF INVENTORY

**7. Non-conformance stock:** Similar to deadstock. The difference is that they can be utilized by other parties

- Could still be used by other parties/companies







# PURPOSE OF HOLDING INVENTORY

1. Creating a cushion for uncertainties
2. Holding batch stock
3. Providing for seasonal stock or anticipation stock
4. Providing for strategic stock
5. Enabling smooth production processes
6. Compliance with legal/contract requirements
7. Overcoming supply disappointments
8. Compensating for a shutdown in production

# PURPOSE OF HOLDING INVENTORY

## 1. Creating a cushion for uncertainties

- Three major kinds
  - » **Uncertainty in demand:** this implies that information related to when/how/if a customer will order is indeterminate
  - » **Uncertainty in supply:** when information related to when/how/if a supplier will deliver the quantity demanded is indeterminate
  - » **Uncertainty in yield:** This indicates that exactly how much needs to be produced for a finite stock of materials, is unknown



- 2. Holding batch stock**
- 3. Providing for seasonal stock or anticipation stock**
- 4. Providing for strategic stock**
- 5. Enabling smooth production processes**
- 6. Compliance with legal/contract requirements**
  - Guarantee stock
- 7. Overcoming supply disappointments**
- 8. Compensating for a shutdown in production**





# INVENTORY HOLDING COSTS

1. **Capital cost:** include the funds spent to purchase inventory as these funds could have been invested in something else (opportunity cost)
2. **Cost of obsolescence:** Incurred when an item in inventory becomes obsolete before it is used or sold
3. **Handling and storage costs:** includes mortgage on, or rent of, a warehouse; salaries for warehouse employees; equipment for handling inventory; etc.



# INVENTORY HOLDING COSTS

1. **Capital cost:** include the funds spent to purchase inventory as these funds could have been invested in something else (opportunity cost). It is the rate of return that could have been earned by putting the same money into a different investment with equal risk



# INVENTORY HOLDING COSTS

**2. Cost of obsolescence:** Incurred when an item in inventory becomes obsolete before it is used or sold





# INVENTORY HOLDING COSTS

**3. Handling and storage costs:** includes mortgage on, or rent of, a warehouse; salaries for warehouse employees; equipment for handling inventory; etc.





*Table 5.1 Inventory holding costs for three different wholesalers*

	Capital	Handling	Obsolescence	Total
Wholesaler luxury fashion wear	8% <sup>x</sup>	12%	15%	35%
Wholesaler ferrous/non-ferrous metals	18% <sup>y</sup>	15%	4%	37%
Wholesaler electronics	12% <sup>z</sup>	10%	3%	25%

<sup>x</sup>Based on interest + percentage; <sup>y</sup>Based on ROI; <sup>z</sup>Based on opportunity costs

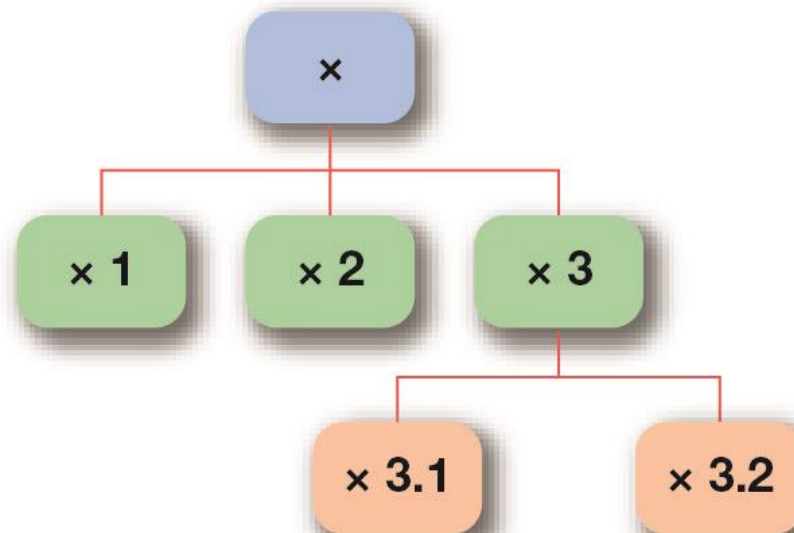
# DEMAND AND INVENTORY

## Independent demand and dependent demand

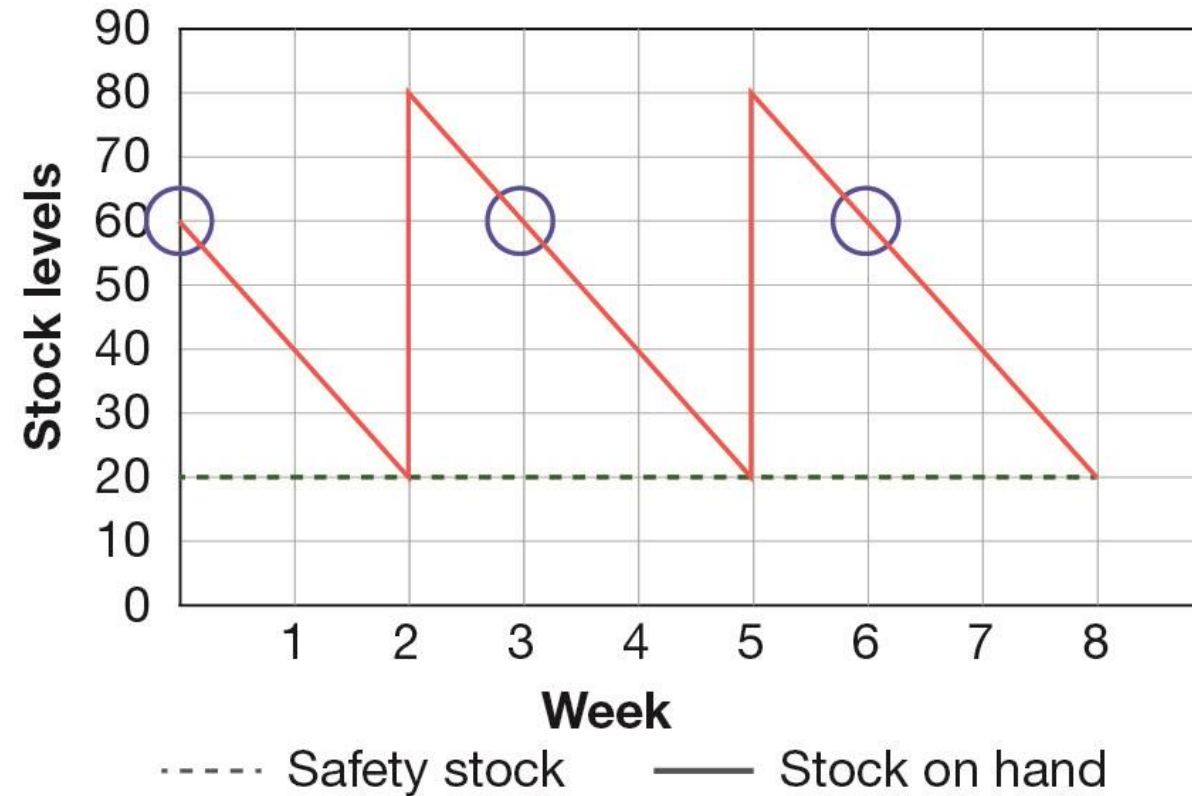
**Independent demand:** these items are usually finished goods whose demand levels are directly related to existing customer requirements

**Dependent demand:** the demand for the item is dependent upon the level of demand for another item (the independent demand item)

*Figure 5.2 Independent and dependent demand items*



*Figure 5.3 Independent demand stock levels*

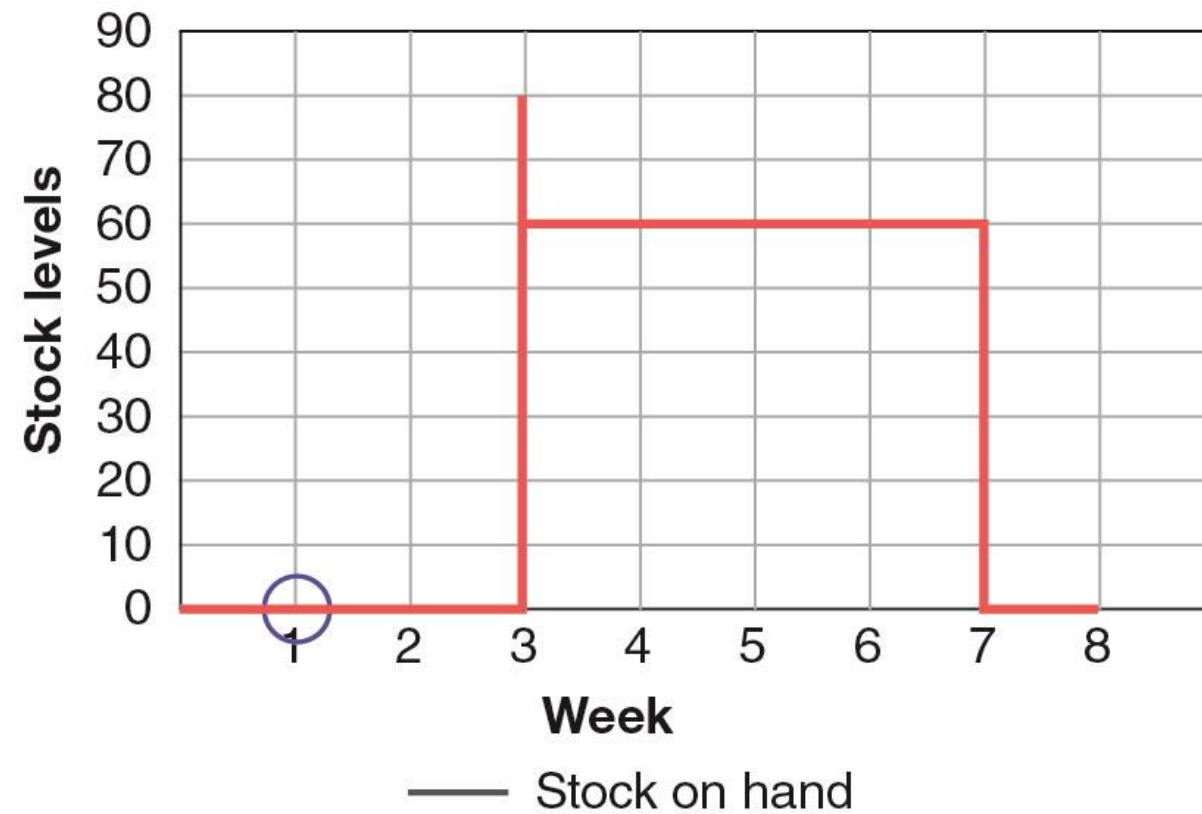


Reorder level = Safety stock + Demand during lead time





*Figure 5.4 Dependent demand stock levels*





# FORECASTING

## Qualitative forecasting

- **Panel consensus method**
  - Five phase process
- **Delphi method**
  - An interactive forecasting process involving a panel of experts. It is a kind of consensus process, but employs the use of a single panel of experts.
  - Number of sequential rounds



## Quantitative forecasting

- Simple average
- Year-to-date
- Moving average
- Weighted average
- ~~Exponential smoothing~~
- ~~Seasonal analysis~~
- ~~Evaluation of forecast quality~~

**Simple average:** Entails the sum of the forecast and actual demand figures from the previous month, and the determination of the mean.

$$F_{t+1} = \frac{A_t + F_t}{2}$$

Period	Forecasted figures	Actual figures
January	245	220
February	390	340
March	210	230
April	302	265
May	435	440
June	336	350

## *Year-to-date average*

Entails the sum of the actual demand figures from the previous months and the determination of their mean.

$$F_{t+1} = \frac{A_t + A_{t-1} + A_{t-2} + \dots + A_{t-n+1}}{n}$$

Period	Forecasted figures	Actual figures
January	245	220
February	390	340
March	210	230
April	302	265
May	435	440
June	336	350

## Moving average

Entails the sum of the actual demand figures from only a predetermined number of previous months in the year and the determination of their mean

$$F_{t+1} = \frac{A_t + A_{t-1} + \dots + A_{t-n+1}}{n}$$

Period	Forecasted figures	Actual figures
January	245	220
February	390	340
March	210	230
April	302	265
May	435	440
June	336	350

3-month moving average example





## Weighted average

Entails the application of weights to the forecasted and actual demand figures of the previous month only

$F_{t+1} = xA_t + yF_t$  (where the sum of the weights  $x$  and  $y$  is 1)

You can use the formula below:

$$F_{t+1} = w_1A_{t-1} + w_2F_{t-1}$$

Period	Forecasted figures	Actual figures
January	245	220
February	390	340
March	210	230
April	302	265
May	435	440
June	336	350

# VALUE OF INVENTORY ITEMS

Italian economist, Pareto, discovered that 80% of the property in Italy was owned by 20% of the people, therefore the 80:20 rule for products exist.

**Step 1:** Determine the quantities of inventory items utilised in a period, usually annually

**Step 2:** Calculate the expenditure on each item y multiplying the quantity usage by the items unit cost

**Step 3:** Rearrange the inventory items in descending (high to low) order

**Step 4:** Categorise the items accordingly as A, B or C

*Table 5.8 Generic ABC categorisation*

Category	Percentage of item (in terms of quantities)	Item value percentage (relative to overall items stored)
A	5%	75%
B	20%	20%
C	75%	5%





*Table 5.9 Annual expenditure on items*

Item number	Annual consumption	Unit cost (R)	Annual expenditure or item value (R)	Value sequence
SK 516	145	860	124 700	5
SK 027	44	15 800	695 200	2
SK 005	31	32 456	1 006 136	1
SK 712	15	20 250	303 750	3
SK 089	780	30	23 400	11
SK 071	91	1 350	122 850	6
SK 312	100	1 380	138 000	4
SK 444	375	135	50 625	8
SK 602	550	92	50 600	9
SK 012	180	110	19 800	12
SK 901	333	75	24 975	10
SK 196	142	830	117 860	7



*Table 5.10 ABC categorisation of items*

Item number	Annual expenditure or item value (R)	Value percentage	Cumulative percentage	Category
SK 005	1 006 136	37.57	37.57	A
SK 027	695 200	25.96	63.53	A
SK 712	303 750	11.34	74.87	A
SK 312	138 000	5.15	80.02	B
SK 516	124 700	4.66	84.68	B
SK 071	122 850	4.59	89.27	B
SK 196	117 860	4.40	93.67	B
SK 444	50 625	1.89	95.56	C
SK 602	50 600	1.89	97.45	C
SK 901	24 975	0.93	98.38	C
SK 089	23 400	0.87	99.25	C
SK 012	19 800	0.74	100.00	C

# ECONOMIC ORDER QUANTITY (EOQ)

## EOQ Method – Different from textbook

The aim of the EOQ Method is to keep inventory costs to a minimum. The two major cost components to be considered **Ordering costs (OC)** and the **Holding costs (HC)**.

- **Ordering Costs (OC)** are all the expenses incurred in the process of placing an order for items.

FORMULA:

- $\text{Ordering cost (OC)} = \text{Cost of placing an order}$

- **Holding Costs (HC)** are the costs incurred in keeping the inventory item.

FORMULA:

- $\text{Holding cost (HC)} = \text{Value of items to be held (V)} \times \text{Holding percentage (H)}$



# ECONOMIC ORDER QUANTITY (EOQ)

FORMULA – DIFFERENT FROM TEXTBOOK!!!!

$$EOQ = \sqrt{\frac{2 \times \text{annual demand} \times OC}{HC}}$$



# ECONOMIC ORDER QUANTITY (EOQ)

## EOQ Method Question 1:

ABC Ltd. Is engaged in sale of Soccer balls. Suppose the annual demand for an inventoried item is 1,200 units. The holding cost for it is R3 per unit per year. The ordering rate is R50 per order placed.

$$EOQ = \sqrt{\frac{2 \times \text{annual demand} \times OC}{HC}}$$

$$\sqrt{\frac{2 \times 1\,200 \times 50}{3}} = 200 \text{ units}$$





# SECTIONS TO LEAVE OUT

**5.6 INVENTORY MANAGEMENT**

**5.7.2 RANDOM DEMAND AND PREDICTIVE DEMAND**

**5.7.3 FAST DEMAND AND SLOW DEMAND**

**5.8 ANALYSIS OF DEMAND**

**5.9.2.5 EXPONENTIAL SMOOTHING**

**5.9.2.6 SEASONAL ANALYSIS**

**5.9.2.7 EVALUATION OF FORECAST QUALITY**

**5.11 ORDERING SYSTEMS (EXCEPT FOR EOQ METHOD)**