

MGT705 – Advanced Cost and Management Accounting

Lecture 1 – 45 Slides

Annual holding cost (Rs)		100	200	300	400
Annual ordering cost (Rs)	400	200	134	100	
Total relevant cost(Rs)	500	400	434	500	

The Economic Order Quantity (EOQ) is 400 units. At this point the total annual relevant costs are at a minimum.

Note

No of Pos D/ order qty; Holding cost=avg stock* Rs1 per unit

EOQ Graph

- P 1079
- Fig 25.1
- Please insert from Colin Drury book, 6th edition.

EOQ – formula method

- Economic order quantity can be found by applying a formula.
- The formula incorporates basic relationship between holding and ordering costs, and order quantities.
- Number of orders for a period is the total demand for the period (D) divided by the quantity in each order (Q).
- The ordering cost is obtained by multiplying the number of orders for a period by the cost per order (O).

EOQ – formula method

- Hence ordering cost is given by:
- Demand for the period x cost per order = DO quantity in each order Q

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- Holding costs will be the average stock ($Q/2$) multiplied by the holding cost per unit (H).
- quantity of order/2 x holding cost per unit = $\frac{QH}{2}$

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image slide

- Hence ordering cost is given by:
- Demand for the period x cost per order = $\frac{DO}{Q}$
quantity in each order
- Holding costs will be the average stock ($Q/2$) multiplied by the holding cost per unit (H).
- quantity of order x holding cost per unit = $\frac{QH}{2}$

EOQ – formula method

- Total cost for any order qty (TC) = $\frac{DO}{Q} + \frac{QH}{2}$
- We can determine the minimum with respect to Q as $Q = \frac{2 DO}{H}$
 - Q: quantity ordered; D: demand for the period
 - O: cost per order; H: holding cost per unit

Assumptions of EOQ formula

- Holding cost per unit will be constant – additional storekeepers might be hired as the stocks increase beyond a certain level.
- Average stock balance is equal to one half of the order quantity i.e. constant amount of stock is consumed per day.
- Despite the approximations in the data, the calculation of EOQ is still likely to be useful.

Example - EOQ

- In the example discussed earlier, if we apply the formula method, the result is:

$$\begin{aligned}\text{Total cost TC for EOQ of 400 units} &= \frac{DO}{Q} + \frac{QH}{2} \\ &= \frac{40000}{400} \times 2 + \frac{400 \times 1}{2} \\ &= \text{Rs } 400.\end{aligned}$$

LECTURE # 37

Relevant holding costs*

- Warehousing and storage: salary of storekeeper, depreciation of equipment, fixed rental of buildings and equipment are irrelevant.
- If space can be rented out, it should be included as opportunity cost.
- Insurance cost should be included only when premiums are charged on fluctuating levels of stocks. Fixed annual insurance cost is not a relevant holding cost.
- The opportunity cost of holding stocks is reflected in the required return from investment.
- `<iframe width="425" height="349" src="http://www.youtube.com/embed/jHZTIEPpOCA" frameborder="0" allowfullscreen></iframe>`

Note:EOQ – vehicles at a petrol station filling petrol; people at ATM machines drawing cash; scene of warehouse operation.

Relevant ordering costs*

- Ordering costs consist of preparing a purchase order, receiving deliveries and paying invoices.
- To estimate variable cost of ordering, the number of orders placed is used.
- The cost of acquiring stock is not relevant as it remains unchanged irrespective of the order size or stock level. (except where quantity discounts are available – discussed later).
- Ordering and holding costs will change in relation to the order size, these will be relevant for decision making models.

Economic order quantity (EOQ)

- If more units are ordered at one time, fewer orders will be required per year. This will mean reduction in ordering cost.
- However, when fewer orders are placed, larger average stocks must be maintained, this leads to an increase in holding cost.
- The optimum order size is one where the total amount of ordering and holding costs are minimized. This is known as the Economic Order Quantity (EOQ).

Example - EOQ

- A company purchases a raw material from an outside supplier at a cost of Rs 9 per unit. The total annual demand for this product is 40,000 units, and the following additional information is available.
- Required annual return on investment in stocks (10% x Rs9)
0.9
- Other holding cost per unit 0.1

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- Holding cost per unit 1.00
- Cost per purchase order 2.00
- Determine optimal order quantity.

Example - EOQ

Order quantity	200	400	600	800
Average units in stock	100	200	300	400
Number of Purchase orders	200	100	67	50
Annual holding cost(Rs)	100	200	300	400
Annual ordering cost (Rs)	400	200	134	100
Total relevant cost(Rs)	500	400	434	500

The Economic Order Quantity (EOQ) is 400 units. At this point the total annual relevant costs are at a minimum.

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- Hence ordering cost is given by:
- $\frac{\text{Demand for the period}}{Q} \times \text{cost per order} = \frac{DO}{Q}$ quantity in each order
- Holding costs will be the average stock ($Q/2$) multiplied by the holding cost per unit (H).
- $\frac{\text{quantity of order}}{2} \times \text{holding cost per unit} = \frac{QH}{2}$
- Total cost for any order qty (TC) = $\frac{DO}{Q} + \frac{QH}{2}$
- We can determine the minimum with respect to Q as $Q = \text{square root of } \frac{2 DO}{H}$
 - Q: quantity ordered; D: demand for the period

O: cost per order; H: holding cost per unit

Assumptions of EOQ formula

- Holding cost per unit will be constant – additional storekeepers might be hired as the stocks increase beyond a certain level.
- Average stock balance is equal to one half of the order quantity i.e. constant amount of stock is consumed per day.
- Despite the approximations in the data, the calculation of EOQ is still likely to be useful.

Example of eoq

- In the example discussed earlier, if we apply the formula method, the result is:

$$\begin{aligned}\text{Total cost TC for EOQ of 400 units} &= \frac{DO}{Q} + \frac{QH}{2} \\ &= 40000 \times \frac{2}{400} + 400 \times \frac{1}{2} \\ &= \text{Rs } 400.\end{aligned}$$

LECTURE # 38

Optimum lot size for a production run

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- The EOQ formula can be adapted to determine the optimum length of the production run when set-up cost is incurred only once for each production run.
- Set-up costs include: labor, material, machine- down time and other related costs.
- Optimum number of units to be manufactured in each run involves balancing set-up costs with holding costs.
- To apply EOQ formula, simply substitute set-up costs for ordering costs.
- $Q = \frac{2DS}{H}$
- Assume annual demand D for a product is 9000 units. Labour and other expenses for production run require set-up cost of Rs 90. Holding cost is Rs 2 per unit per year. The EOQ model can be used to determine how many units should be scheduled for each run:
- $Q = \frac{2 \times 9000 \times 90}{2} = 900$
- With a demand of 9000, and production run of 900 units per run, there will be 10 production runs.
- If working days are 300 hundred each year, there should be a production run every 30 days.
- If demand is 9000 then 30 units are required each day, (divided by 300 days) and if setup takes three days, production run should be started when stock level reaches 90 units.

Quantity discounts*

- Where firms are able to obtain quantity discounts for large purchase orders, the price per unit will differ, and this must be taken into account in the EOQ.
- The differences will arise as follows:
 - Saving in purchase price

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- Reduction in ordering cost,
- Increase in holding cost from higher stock levels.

Example – discounts

- A company purchases raw materials at a cost of Rs 7 per unit. The total annual demand for this product is 9000 units. The holding cost is Rs 4 per unit and the ordering cost is Rs 5 per order.
- A quantity discount of 3% of purchase price is available for orders in excess of 1000 units.
- Should the company order in batches of 1000 units and take advantage of quantity discounts?
- Starting point is to calculate the EOQ, and then decide whether the benefits exceed the cost.
- $EOQ = \frac{2 \times 9000 \times 5}{4} = 150 \text{ units}$
- Savings made if purchase is in batches of 1000 instead of 150 units:

– price: 3% x 63000	1890
– ordering cost: $\frac{9000 \times 5}{1000} - \frac{9000 \times 5}{150}$	255
– Holding cost: $\frac{(1000 - 150) \times 4}{2}$	-1700

The re-order point*

- To determine the re-order point, we must ascertain the lead time (the time taken between placing the order and delivery of stocks).
- The re-order point will be the number days in lead time multiplied by the daily usage during that period.
- For a manufacturer the re-order point is the level of finished goods stock at which production order should be issued.
- For materials and components, it is the time when the purchase requisition is initiated.

Example – reorder point

- Assume annual usage of raw material is 6000 units, and weekly usage is constant.
- In 50 working weeks in a year, the weekly usage will be 120 units.
- If the lead time is 2 weeks, order should be placed when stocks fall to 240 units.
- EOQ can indicate how frequently the stock should be purchased.
- If $EOQ = 600$, and annual demand = 6000, ten orders will be placed every five weeks.
- However, with a lead time of two weeks, the firm will place an order three weeks after the first delivery, when the stock will have fallen to 240 units. (600 units EOQ less three weeks usage at 120 units per week). The order will then be repeated with five weekly intervals.
- The EOQ model can therefore be used to indicate when to replenish stock and the amount to replenish.

Safety stocks*

- Safety stocks are the amount of stocks that are carried in excess of the expected use during the lead time.
- This provides a cushion against running out of stocks because of fluctuations in demand.
- E.g lead time = 2 weeks, weekly usage = 120 units; re-order point will be 240 units.
- However, if weekly usage increases to 140 units during lead time, or lead time goes up to three weeks, the firm will fall short of stock.

Safety stocks

- Response of a firm may be to re-order at 420 units to allow 140 units usage for three weeks.
- This will consist of re-order point based on normal usage and lead time of 240 units, plus 180 units of safety stock. This covers the possibility that lead time and expected usage will be greater than projected.

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- Thus re-order point is computed by adding safety stock to average usage during average lead time.
- Maintaining high safety stock will not be appropriate where the cost of holding the excessive stock is higher than the cost of stock-out.
- Stock-out costs are the opportunity cost of running out of stock. For finished goods, this will be the loss of contribution.
- The level should be set where the cost of stock-out plus the cost of holding the safety stocks are minimized.

LECTURE # 39

**Control of stocks through
classification***

- Large firms may have thousands of items to be stored. It is not possible to apply EOQ to all.
- Stocks should be classified and elaborate techniques applied to important categories.
- A common procedure is the ABC classification.
- An estimate is made of the total purchase cost of each item of stock for the period. Sales forecast is the basis for estimating quantities.
- A school with children in classrooms, different classes; a supermarket with different sections for different types of goods e.g. toiletries, household, confectionery...

**Control of stocks through
classification***

- Each item is then grouped in decreasing order of annual purchase cost.
- Top 10% of items in terms of annual purchase cost are included in category A.
- Next 20% is B and the final 70% is C.
- If there are 10000 items, the top 1000 in terms of annual purchase cost are A.
- In practice it will be unnecessary to have elaborate controls on the 7000 C items.
- First division, second div and third div in college results. Show college, students receiving results, convocation ceremony.

Illustration – ABC categories*

- Stage 1: estimate annual purchase cost

Item	usage	price	purchase cost
1	60000	1.00	60,000
2	20000	0.05	1000
3	1000	0.10	100
4	10000	0.02	200
5	100000	0.01	1000
6	80000	2.00	160000

The list continues for all items

- Stage 2: group items, A top 10%, B 20%, C 70%

The analysis may look like:		items	%	Cost	%
Class A		1000	10	730000	73
Class B		2000	20	190000	19
Class C		7000	70	80000	8
10000	100	1000000	100		

Top 30% account for approx 90% of value; 80-20 rule

Other factors influencing order quantity

- Shortage of future supplies:
 - Future supplies may be restricted due to import problems or transport difficulties etc.
 - In anticipation a firm may over order stocks to meet production needs.
- Future price increases:
 - Supplier announces price increase at future date
 - Firm may buy in excess of requirement

- Obsolescence
 - Stocks may be subject to obsolescence due to changes in technology, fashion, perishable goods.
 - purchases of small quantities and low stock may be appropriate.

Steps to reduce safety stocks

- When demand is uncertain, safety stocks are likely to be high.
- Safety stocks may be reduced as follows:
 - New suppliers are identified who promise quicker and more reliable deliveries.
 - Existing suppliers pressurized for faster deliveries.
 - The lower the average delivery time, the lower will be the safety stock, and the firm's investment in stocks.

Performance reporting

- Managers are likely to concentrate only on those variables that are measured.
- They will take action that will improve their performance rating, even if not always in the best interest of the company.
- If annual holding costs are not allocated to managers, they may be induced to obtain larger order sizes. Consequently less frequent production runs will occur.
- This will reduce annual cost charged to the manager.
- This situation can be avoided by charging holding costs to the relevant manager.

Materials Requirement Planning (MRP)

- In complex manufacturing environments, the demand for materials purchases is dependent on the volume of planned output of components and sub-components.
- They include raw materials which have to be purchased.

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- Materials requirement planning (MRP) is a computerized approach for coordinating the planning of materials acquisition and production.

MRP

- The major feature of MRP is that it involves an estimation of the quantity and timing of finished goods; and then uses this to determine the requirements for components / sub-components at each stage of production.
- The aim of MRP is to generate a planned coordinated schedule of materials requirement for a specified time period.
- It takes into account scheduled receipts, projected target stock levels, and items allocated to production, but not yet drawn.

MRP and EOQ

- The EOQ model can be used within the MRP systems to determine economic quantity sizes to be purchased.
- Care should be taken to ensure that assumption of EOQ model of constant demand applies broadly.
- MRP has later been extended to management of all manufacturing resources, including machine capacity planning and labor scheduling.

LECTURE # 40:

JIT purchasing arrangements

- **The goals of JIT include:**
 - Eliminating non value added activities
 - A batch size of one, and
 - Zero inventories
- JIT philosophy has been extended to the purchasing function.
- JIT techniques seek to ensure delivery of material immediately precedes their use.

JIT