

## **MGT705 – Advanced Cost and Management Accounting**

### **Lecture 1 – 45 Slides**

- 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.
- $EOQ = \frac{2 \times 9000 \times 5}{4} = 150$  units
- Savings made if purchase is in batches of 1000 instead of 150 units:
  - price:  $3\% \times 63000$  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.

- 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**

- Improved service is obtained by giving more business to fewer suppliers, and placing long-term purchase orders.
- Major feature of JIT purchasing is that suppliers are not selected on the basis of price alone.
- Performance on quality, delivery as needed and commitment to JIT are vital.

## Other advantages of JIT

- **Include:**
  - significant quantity discounts
  - Savings in time from negotiating with fewer suppliers.
  - Reduction in clerical work from issuing long-term orders.
- By seeking to ensure that production and purchases are timed to coincide with demand, the determination of EOQ and re-order point are no longer required.

## Example – Relevant Costs and Optimum Batch-size

- Ferozee Ltd manufactures an item called badam, the annual demand is 4000 units spread evenly throughout the year.
- Production takes place 4 times a year in batches of 1000 units.
- One raw material input for badam is the unnab, also manufactured by Ferozee.
- Unnab is produced in large quantities and there is sufficient production capacity.

The standard costs of producing badams and unnabs are:

| Badam               | Unnab       |
|---------------------|-------------|
| Raw materials       | 13      8   |
| Unnab standard cost | 22          |
| Labor – unskilled   | 7      4    |
| - skilled           | 9      5    |
| Variable overheads  | 5      3    |
| Fixed overheads     | 4    2      |
| Standard Cost       | <u>6022</u> |

Included in fixed costs for badam are the set up costs for each production run.

Cost per set up are:

|                             |            |
|-----------------------------|------------|
| Labor costs – skilled labor | 66         |
| machine parts               | <u>70</u>  |
| total                       | <u>136</u> |

There are no set up costs of unnab.

Example – Relevant Costs and Optimum Batch-size

- The cost of financing stocks of badams is 15%.
- Each unit requires 0.40 square meters of storage space. Warehouse rent is Rs 20 p.a. per sq m. Ferozee only pays for storage space actually used.
- Idle payment is made to all except unskilled labor, these are paid only for work carried out.
- Required (a) Show optimum batch size for badam. Calculate savings if different from current policy.

Solution

- Optimum batch size  $Q = \frac{2DS}{H}$
- Relevant cost of production of badam is:

|                                |             |
|--------------------------------|-------------|
| – Raw materials                | 13          |
| – Unnab std cost – raw mat     | 8           |
| – unskilled lab                | 4           |
| – variable overheads           | <u>3</u> 15 |
| – Unskilled labor              | 7           |
| – Variable overheads           | <u>5</u>    |
| Incremental cost of production | 40          |

- Annual demand of badams is 4000 units
- Set up cost = Rs 70 (skilled labor Rs 66 is fixed)
- Annual holding cost is Rs 14 (storage Rs 8 + capital tied up in stock Rs 6.
- Storage: .4 sq m x Rs 20 = Rs 8
- Capital cost: 15% x Rs 40 = 6
- Applying the formula:

$$Q = \text{square root of } \frac{2 \times 4000 \times 70}{14} = 200 \text{ units}$$

## Cost savings

- Current policy:
  - Set up cost (4 x 70) 280
  - Holding cost (1000/2 x 14) 7000 7280

### Optimum policy:

Set up cost (4000/200 x 70) 1400

|                                    |             |             |
|------------------------------------|-------------|-------------|
| Holding cost ( $200/2 \times 14$ ) | <u>1400</u> | <u>2800</u> |
| Annual savings                     |             | <u>4480</u> |

## Example (cont) Quantity discount

- The second stock item is the product jamun, this is purchased for resale and annual demand of 10000 units is spread evenly throughout the year.
  - Incremental ordering costs are Rs 100 per order and normal unit cost is Rs 20.
  - Suppliers of jamun are offering quantity discounts as follows:
- |                        |      |
|------------------------|------|
| Qty ordered – upto 999 | 20   |
| 1000 – 1999            | 19.8 |
| 2000 and above         | 19.6 |
- Holding costs for jamun are Rs 8 per unit per year.
  - Required (b) What is the correct order size for jamun

### Solution

$$Q = 2DO / H$$

$$= \frac{2 \times 10000 \times 100}{10000} = 200 \text{ units}$$

Comparison with savings from discounts at 19.80

|                                                                                              |      |
|----------------------------------------------------------------------------------------------|------|
| - Savings in price: $(10000 \times .2)$                                                      | 2000 |
| - Savings in ordering cost:<br>$\frac{1000}{(10000/1000 \times 100)-(10000/500 \times 100)}$ |      |
| total savings                                                                                | 3000 |

Additional holding cost:  $1000 - 500/2 \times 8 = 2000$

Savings from order size of 1000 at 19.8 = 1000

## Quantity discount

- Discount for 2000 units at 19.60
  - Savings in price ( $10000 \times .4$ ) 4000
  - Savings in order cost 1500  $(10000/2000 \times 100) - (10000/500 \times 100)$
  - Total savings 5500
  - Additional holding cost:  
 $(2000 - 500)/2 \times 8 = 6000$

Additional cost is higher than savings.

Ferozee should purchase batches of 1000 at a price of Rs 19.80

### **LECTURE # 41**

## Application of Linear programming\*

- We established that where a scarce resource exists, the contribution per unit of the scarce resource should be calculated.
- The resource should then be allocated to different products on the basis of this contribution per unit. This will maximize profits.
- Where more than one scarce resource exists, the optimum production program cannot be easily established by the above process.

## Example – 2 scarce resources

The ZB company produces 2 products. The standards per unit of product are as follows:

Product BB Product MB

Standard selling price

Less variable standard costs:

- Materials (BB - 8@4; MB 4@4)

- Labor (BB 6hrs@10; MB 8hrs@1

- Variable overhead (BB 4hr@1; N

Variable cost

Contribution

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