

Industrial & Management Engineering Department

Industrial Relations

IM 111

Lecture 5: Cost Analysis

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Industrial Costs

1. Introduction

Any organization, whether it is a business, a governmental department or a charitable foundation will eventually fail if its costs exceeds its revenue.

Therefore, costs are fundamental to all enterprises including engineering. Engineering businesses must make a profit. This is the business imperative; **revenue must exceed costs.**

2. The cost of a product

Consider an entirely new product. What are the expected costs of the product? These may be any or all of the following costs:

- Market research cost
- Design and specification cost

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- Prototype manufacturing cost
- Development cost
- Tooling cost
- Manufacturing cost
- Marketing cost
- Distribution cost
- Product support cost

If the product met a success and the productivity increased, certainly there will be identifiable materials cost and labour costs. But there will be other costs, such as; heating and lighting, depreciation in the value of the buildings and equipment, consumables used in maintenance and servicing, salaries of supervisory staff, administration, etc.

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3. Elements of production costs

Costs can be classified based upon their effects on production into:

- Materials costs
- Labour costs
- Overhead costs

$$\textit{Total cost} = \textit{Materials costs} + \textit{Labour costs} + \textit{Overhead costs}$$

Materials Costs:

These are the costs of materials or components included and appearing in the final product. They vary in accordance with the production volume. The increase in the production volume leads to an increase in the material costs. Thus they are variable in nature and directly affected by (proportional to) the production volume.

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Labour Costs:

These are the wages of labour performing the production processes. These costs also vary in accordance with the production volume. The increase in the production volume leads to an increase in the production time and hence the required labour costs. Therefore, they are variable and directly affected by/proportional to the production volume.

Overhead Costs:

These costs refer to all cost items other than materials and labour costs. They may be classified into the following:

- Manufacturing overhead costs
- Administration overhead costs
- Sales and marketing overhead costs

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4. Direct and Indirect Costs

Costs can be classified also based on their effects on the production into:

- Direct costs
- Indirect costs

$$\boxed{\textit{Total cost} = \textit{Direct costs} + \textit{Indirect costs}}$$

Direct Costs

These are costs that arise directly from production. The increase in the production volume results in an increase in the direct costs. Examples of these costs include direct material and direct labour costs.

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Indirect (Overhead) Costs

These are the costs that arise whether production takes place or not. Therefore, they are not directly affected by the production. Examples include; renting cost, administration costs, heating and lighting cost, marketing cost.

5. Measuring the costs of materials and components

Among all costs, materials costs are clearly the most identifiable as direct cost. If a production centre uses material or good then cost is considered. If production does not take place, the materials or goods are not considered and no cost arises.

But, what would be the situation if the stock was supplied by different suppliers at different prices over a period of time?

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- Two common methods are used for determining the value of the stock. They are :
 - First in first out **FIFO** method
 - Last in first out **LIFO** method

- **First In First Out (FIFO) Method**

In this case the amount charged to the cost centre will reflect the cost of the earliest material/items delivered to the store.

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Example

Stock items have been delivered to the store on the first day of every month according to the quantities and the prices listed in the table below:

Date	Number of items	Price, L.E.
1 February	300	20
1 March	400	21
1 April	350	20
1 May	300	22

On the last day of May, 800 items were drawn from the stock. What would be the amount charged to the production centre?

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Solution

Number of items	Cost/unit, L.E	Cost, L.E
300	20	6000
400	21	8400
100	20	2000
Total cost		16,400

The value of the remaining stock can also be calculated as follows:

$$\begin{aligned}\text{Value of remaining stock} &= (250 \times 20) + (300 \times 22) \\ &= 5000 + 6600 \\ &= \mathbf{11,600 \text{ L.E}}\end{aligned}$$

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Note:

A consequence of this method of costing is that the costs charged to the production centre are low relative to current prices of materials.

Last In First Out (LIFO) Method

The alternative case is to charge the cost centre at prices which reflect the current prices of buying in stock.

The same data will be used as in the previous example and accordingly the solution will differ as follows:

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Solution

Number of items	Cost/unit, L.E	Cost, L.E
300	22	6600
350	20	7000
150	21	3150
Total cost		16,750

This is a higher cost compared to what has been charged using the FIFO method. The value of the remaining stock can now be calculated and this will give:

$$\begin{aligned}\text{Value of remaining stock} &= (250 \times 21) + (300 \times 20) \\ &= 5250 + 6000 \\ &= \mathbf{11,250 \text{ L.E}}\end{aligned}$$

This is a lower value and therefore it might be preferred.

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Measuring the Labour Cost

Most labour costs are time related costs. Therefore, labour wages can be calculated as:

$$\textit{Labour wage} = \textit{hour worked} \times \textit{hourly rate}$$

Hourly rates will also vary with the number of hours worked in a day and in a week.

- Higher, overtime rates usually must be paid if the hours worked on a given day exceed a prescribed maximum number.
- Working for more than e.g. 37 hours per week or working over weekends may also entitle the individual to overtime payments.

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The wages bill is only one part of the cost of employing labour. In addition, there can be provision for:

- Holiday payment,
- Sick leave payment,
- National insurance,
- Private medical insurance,
- Pension schemes and industrial training, and
- Possibly travelling and accommodation expenses

However the actual cost may depend upon the actual hours worked and on the productivity of the individual and would include a number of other indirect costs.

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- What has to be done in order to allocate labour costs against production is to agree on a notional labour cost in L.E/hr and to monitor regularly how close this notional costs are to recent historical costs.
- In short, a company as a matter of policy will establish a set of labour rates (for different types of work or for different skills) chargeable as a direct cost to customers and/or internal cost centres. These rates will be updated from time to time.

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Measuring and allocating overhead costs

- Overhead is the term used for indirect costs. Examples of overhead costs are rent, heating and lighting cost, administration cost, marketing cost and research and development cost.
- If a company manufactures a single product, then this product must pay for the total overhead of the company. This case is simple and straightforward.
- If the company manufactures more than one product, e.g. two products; A and B, how should the overhead be calculated for each product?
- Overhead is usually calculated based on the Revenue which is defined as:

$$\text{Revenue} = \text{number of units produced} \times \text{selling price per unit}$$

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Example

A company produces:

1500 units of product **A** per week which sell at a price of 10 L.E/unit,

6000 units of product **B** per week which sell at a price of 6 L.E/unit.

The company overheads are 8000 L.E per week.

Determine the overhead cost that should be assigned to one unit of product A and of product B.

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Solution

$$\text{Revenue for product A} = 1500 \times 10 = 15000 \text{ L.E}$$

$$\text{Revenue for product B} = 6000 \times 6 = 36000 \text{ L.E}$$

$$\text{Total Revenue} = \underline{51000} \text{ L.E}$$

$$\text{Overhead for product A} = 15000 \times 8000 / 51000 = 2353 \text{ L.E}$$

$$\text{Overhead for product B} = 36000 \times 8000 / 51000 = 5647 \text{ L.E}$$

$$\text{Unit overhead cost for product A} = 2353 / 1500 = 1.57 \text{ L.E}$$

$$\text{Unit overhead cost for product B} = 5647 / 6000 = 0.94 \text{ L.E}$$