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MARGINAL COSTING AND BREAK-EVEN ANALYSIS

Introduction

There are mainly two techniques of product costing and income determination :

(a) Absorption costing and (b) Marginal costing.

Absorption Costing

This is a total cost technique under which total cost (i.e. fixed cost as well as variable cost) is charged as production cost. In other words, in absorption costing, all manufacturing costs are 'absorbed' in the cost of the products produced. In this system, fixed factory overheads are absorbed on the basis of a predetermined overhead rate based on normal capacity. Under/over absorbed overheads are adjusted before computing profit for a particular period. Closing stock is also valued at production cost which includes variable cost and fixed factory overhead (and sometimes administration overhead also). Absorption costing approach is the same as used in Cost Sheet. Absorption costing is a traditional approach and is also known as 'Conventional Costing' or 'Full Costing'.

Marginal Costing ✓

An alternative to absorption costing is *marginal costing*, also known as 'variable costing' or 'direct costing'. Under this technique, only variable costs are charged as product costs and included in inventory valuation. Fixed manufacturing costs are not allotted to products but are considered as *period costs* and thus charged directly to the Profit and Loss Account of that year. Fixed costs also do not enter in stock valuation.

Both absorption costing and marginal costing treat non-manufacturing costs (i.e. administration, selling and distribution overhead) as period costs. In other words, these are not inventoriable costs.

Product Costs and Period Costs

It is important to understand the distinction between product costs and period costs. It may be recalled that product costs are those costs which become a part of production cost. Such costs are also included in inventory valuation. Period costs, on the other hand, are those costs which are not included in production cost and inventory valuation. Such costs are treated as an expense of the period in which these are incurred and are written off in the profit and loss account of the period. In marginal costing, only variable costs are treated as product costs. Fixed factory overhead, administration and selling overhead are treated as period costs.

Meaning of Marginal Cost ✓

Marginal cost is the additional cost of producing an additional unit of product. It is the total of all variable costs. It is composed of all direct costs and variable overheads. The CIMA of UK has defined marginal cost 'as the amount at any given volume of output by which aggregate costs are changed, if volume of output is increased or decreased by one unit'. It is the cost of one unit of product which would be avoided if that unit were not produced. An important point is that marginal cost per unit remains unchanged irrespective of the level of activity.

Example. A company manufactures 100 units of a product per month. Total fixed cost per month is Rs. 5,000 and marginal cost per unit is Rs. 250. The total cost per month will be :

Marginal (variable) cost of 100 units @ Rs. 250 per unit	Rs. 25,000
Fixed cost	5,000
Total cost	<u>30,000</u>

If output is increased by one unit from 100 units to 101 units, the cost will appear as follows :

Marginal cost (101 × 250)	Rs. 25,250
Fixed cost	Rs. 5,000
Total cost	<u>Rs. 30,250</u>

Thus the additional cost of producing one additional unit is only Rs. 250, which is its marginal cost.

Meaning of Marginal Costing

Marginal costing is defined by CIMA as *"The accounting system in which variable costs are charged to cost units and fixed costs of the period are written off in full against the aggregate contribution. Its special value is in decision making"*.

Characteristics of Marginal Costing

The essential characteristics and mechanism of marginal costing technique may be summed up as follows :

1. **Segregation of costs into fixed and variable elements.** In marginal costing, all costs are classified into fixed and variable. Semi-variable costs are also segregated into fixed and variable elements.
2. **Marginal costs as product costs.** Only marginal (variable) costs are charged to products produced during the period. In other words, marginal costs are treated as product cost.
3. **Fixed costs as period costs.** Fixed costs are treated as period costs and are charged to the Costing Profit and Loss Account of the period in which they are incurred.
4. **Valuation of inventory.** The work-in-progress and finished stocks are valued at marginal cost only.
5. **Contribution.** Contribution is the difference between sales value and marginal cost of sales. The relative profitability of products or departments is based on a study of 'contribution' made by each of the products or departments.
6. **Pricing.** In marginal costing, prices are based on marginal cost plus contribution.

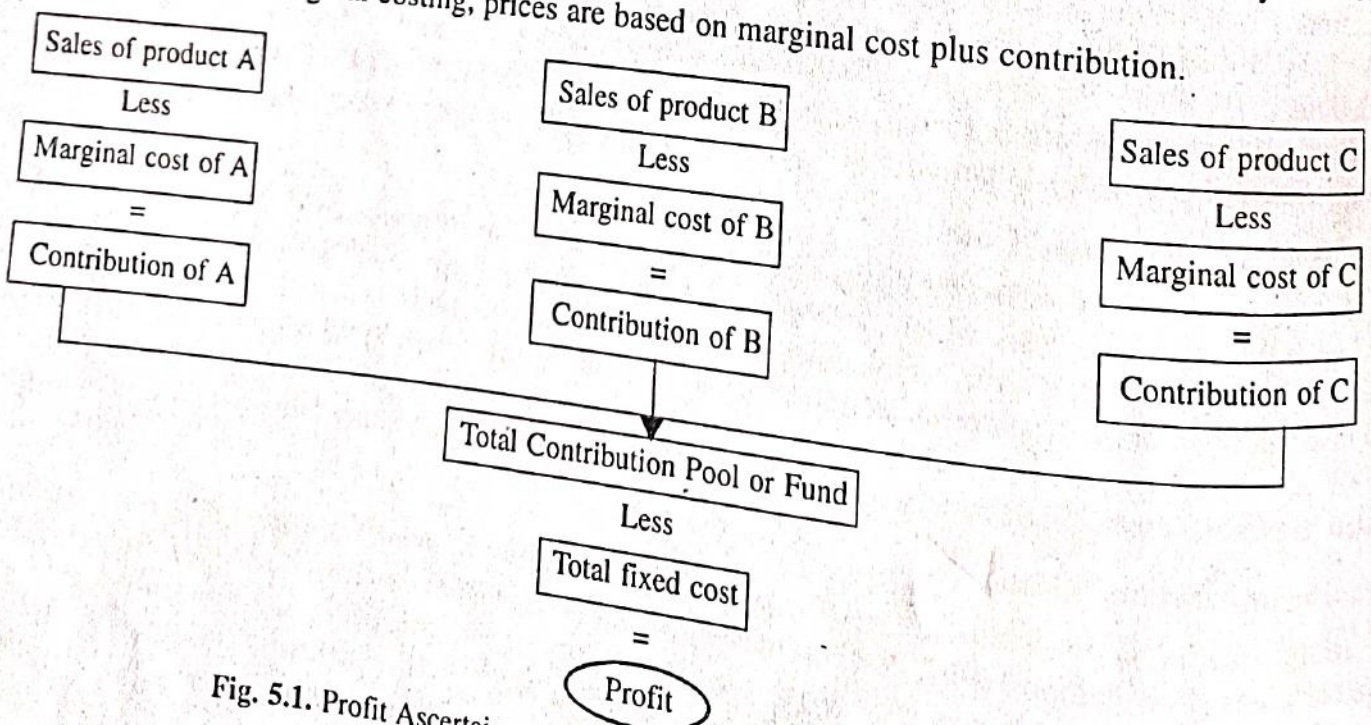


Fig. 5.1. Profit Ascertainment in Marginal Costing in a Multi-product Company

Marginal costing and profit. In marginal costing, profit is calculated by a two-stage approach. First of all, contribution is determined for each product or department. The contributions of various products or departments are pooled together and such a total of contributions from all products is called 'Fund'. Then from this fund is deducted the total fixed cost to arrive at profit or loss. See Fig.

Distinction between Absorption and Marginal Costing

The points of distinction between marginal costing and absorption costing are as follows :

1. Treatment of fixed and variable costs. In marginal costing, only variable costs are charged to products. Fixed costs are treated as period costs and charged to Profit and Loss Account of the period.

In absorption costing, all costs (both fixed and variable) are charged to the product. The fixed factory overhead is absorbed in units produced at a rate predetermined on the basis of normal capacity utilisation (and not on the basis of actual production).

2. Valuation of stock. In marginal costing, stock of work-in-progress and finished goods are valued at marginal cost only.

In absorption costing, stocks are valued at total cost which includes both fixed and variable costs. Thus stock values in marginal costs are lower than that in absorption costing.

3. Measurement of profitability. In marginal costing, relative profitability of products or departments is based on a study of relative contribution made by respective products or departments. The managerial decisions are thus guided by contribution.

In absorption costing, relative profitability is judged by profit figures which is also a guiding factor for managerial decisions.

Income Determination under Marginal Costing and Absorption Costing

The net profit under the two systems may be same or may be different. Difference in profit may be because of the different basis of inventory valuation. In marginal costing, stocks of work in progress and finished goods are valued at variable cost whereas in absorption costing, stocks are valued at total cost.

Illustration 5.1

From the following information, prepare an Income Statement under :

(a) Marginal costing (b) Absorption costing

		Product		
		X	Y	Z
		Rs.	Rs.	Rs.
Direct materials		7,500	30,000	3,000
Direct wages		9,000	9,000	1,500
Factory overhead	— Fixed	3,000	1,500	1,500
	— Variable	3,900	9,000	4,500
Selling overhead	— Fixed	1,500	900	600
	— Variable	2,100	6,000	3,000
Sales		32,000	61,000	16,000

Fixed factory overhead and fixed selling overhead were apportioned to products X, Y, and Z on equitable bases.

Solution

(a) Income Statement (Marginal Costing)

	Products			Total (X + Y + Z)
	X	Y	Z	
	Rs.	Rs.	Rs.	Rs.
Sales (A)	32,000	61,000	16,000	1,09,000
Variable costs :				
Direct materials	7,500	30,000	3,000	40,500
Direct wages	9,000	9,000	1,500	19,500
Variable overhead :				
Factory	3,900	9,000	4,500	17,400
Selling	2,100	6,000	3,000	11,100
Total variable cost (B)	22,500	54,000	12,000	88,500
Contribution (A - B)	9,500	7,000	4,000	20,500
Less : Fixed cost (Total of fixed factory and selling overheads)				9,000
Profit				11,500

(b) Income Statement (Absorption costing)

	Products			Total (X + Y + Z)
	X	Y	Z	
	Rs.	Rs.	Rs.	Rs.
Direct materials	7,500	30,000	3,000	40,500
Direct wages	9,000	9,000	1,500	19,500
Prime cost	16,500	39,000	4,500	60,000
Factory overhead				
—Fixed	3,000	1,500	1,500	6,000
—Variable	3,900	9,000	4,500	17,400
Cost of Production	23,400	49,500	10,500	83,400
Selling overhead				
—Fixed	1,500	900	600	3,000
—Variable	2,100	6,000	3,000	11,100
Total cost	27,000	56,400	14,100	97,500
Profit	5,000	4,600	1,900	11,500
Sales	32,000	61,000	16,000	1,09,000

Comments. It may be noted from the above that total profit under marginal costing and absorption costing is the same i.e., Rs. 11,500. This is because there are no opening and closing stocks of finished goods or work-in-progress. However when there are opening and/or closing stocks, profit/loss under the two systems may be different.

COST-VOLUME-PROFIT ANALYSIS

Cost-volume-profit analysis (CVP analysis) is an extension of the principles of marginal or variable costing. It follows directly from variable costing. This means that principles derived and applied in marginal costing are applicable here.

Every company must earn profits to stay in business. CVP analysis helps management in profit planning. Managers make various plans to increase company profitability. For example, how the profits will be affected if an additional sales promotional expenditure of Rs. 2,00,000 increases sales by 40,000 units? Similarly, how many units of product should be sold to earn a profit of Rs. 2,50,000? If company sells 1,50,000 units, what will be the amount of profit? These and many other similar questions find their answers in the study of CVP analysis.

CVP analysis studies the inter-relationship of three basic factors of business operations:

- (a) Cost of production,
- (b) Volume of production/sales, and
- (c) Profit.

These three factors are inter-connected in such a way that they act and react on one another because of cause and effect relationship amongst them. The cost of a product determines its selling price and the selling price determines the level of profit. The selling price also affects the volume of sales which directly affects the volume of production and volume of production in turn influences cost. In brief, variations in volume of production results in changes in cost and profit. CIMA London has defined CVP analysis as, "the study of the effects on future profits of changes in fixed cost, variable cost, sales price, quantity and mix."

An understanding of CVP analysis is extremely useful to management in budgeting and profit planning. It explains the impact of the following on the net profit :

- (a) Changes in selling prices, ✓
- (b) Changes in volume of sales, ✓
- (c) Changes in variable cost, ✓
- (d) Changes in fixed cost, ✓

In fact, CVP analysis helps in determining the probable effect of change in any one of these factors on the remaining factors.

BREAK-EVEN ANALYSIS ✓

Break-even analysis is a widely used technique to study the CVP relationship. It is interpreted in narrow as well as broad sense.

Narrow meaning. In its *narrow sense*, break-even analysis is concerned with determining break-even point. Break even point is that level of production and sales where there is no profit and no loss. At this point total cost is equal to total sales revenue.

Broad meaning. When used in *broad sense*, break-even analysis is used to determine probable profit/loss at any given level of production/sales. It also helps to determine the amount or volume of sales to earn a desired amount of profit.

Assumptions underlying Break-even Analysis

The break-even analysis is based on the following eight assumptions :

1. All costs can be separated into fixed and variable components.

2. Variable cost per unit remains constant and total variable cost varies in direct proportion to volume of production.
3. Total fixed cost remains constant.
4. Selling price per unit does not change as volume changes.
5. There is only one product or in the case of multiple products, the sales mix does not change.
In other words, when several products are being sold, the sale of various products will always be in some predetermined proportion.
6. There is synchronisation between production and sales. In other words, volume of production equals volume of sales.
7. Productivity per worker does not change.
8. There will be no change in the general price level.

Contribution and Marginal Cost Equation

As stated earlier, contribution is the difference between sales and the marginal (variable) cost sales. It is also known as contribution margin (C_m) or gross margin. Thus contribution is calculated by the following formula :

$$\text{Contribution} = \text{Sales} - \text{Variable cost} \quad (C = S - V)$$

Also, $\text{Contribution} = \text{Fixed cost} + \text{Profit} \quad (C = F + P)$

or $\text{Contribution} = \text{Fixed cost} - \text{Loss} \quad (C = F - L)$

From this, the following marginal cost equation is developed :

$$S - V = F + P$$

If any three of the above four factors in the equation are known, the fourth one can be easily found out. Thus :

$$P = S - V - F$$

$$P = C - F$$

$$F = C - P$$

$$V = S - F - P$$

Example :

$$\text{Sales} = \text{Rs. } 12,000$$

$$\text{Variable cost} = \text{Rs. } 7,000$$

$$\text{Fixed cost} = \text{Rs. } 4,000$$

Thus :

$$C = S - V$$

$$C = 12,000 - 7,000 = \text{Rs. } 5,000$$

$$P = C - F$$

$$P = 5,000 - 4,000 = \text{Rs. } 1,000$$

Thus profit is Rs. 1,000.

If sales figure is not given but contribution is given then sales can be determined as follows

$$S = C + V$$

$$S = 5,000 + 7,000 = \text{Rs. } 12,000$$

Solution

	Product A	Product B
Selling price (<i>S</i>)	Rs. 100	Rs. 110
Direct material	249	14
Direct labour	6	9
Variable overhead	8	12
Variable cost (<i>V</i>)	38	35
Contribution (<i>S - V</i>)	62	75
(a) Contribution per labour hour	Rs. 62 ÷ 2 hrs. = Rs. 31	Rs. 75 ÷ 3 hrs. = Rs. 25
(b) Contribution per rupee of sales value	= Rs. 62 ÷ 100 = 62 paise	= Rs. 75 ÷ 110 = 68 paise

Conclusion

- (a) Product A is recommended when labour time is the key factor because contribution per labour hour of product A is more than that of product B.
- (b) When sales value is the key factor, product B is recommended because contribution per rupee of sales value of product B is more than that of product A.
- (c) When sale quantity is the key factor, product B is more profitable because its contribution per unit is higher than that of product A.

ANGLE OF INCIDENCE

This angle is formed by the intersection of sales line and total cost line at the break-even point (see Fig. 5.2). This angle shows the rate at which profits are being earned once the break-even point has been reached. The wider the angle, the greater is the rate of earning profits. Therefore, the aim of management will be to have as large an angle as possible.

The angle of incidence is of particular importance in boom periods when sales are expanding. Taking in conjunction with margin of safety, therefore, a large angle of incidence with a high margin of safety indicates and extremely favourable position.

GRAPHIC PRESENTATION OF BREAK-EVEN ANALYSIS

Break-even Chart

Break-even chart is a graphic presentation of break-even analysis. This chart takes its name from the fact that the point at which the total cost line and the sales line intersect is the break-even point. A break-even chart not only shows the break-even point but also shows profit and loss at various levels of activity.

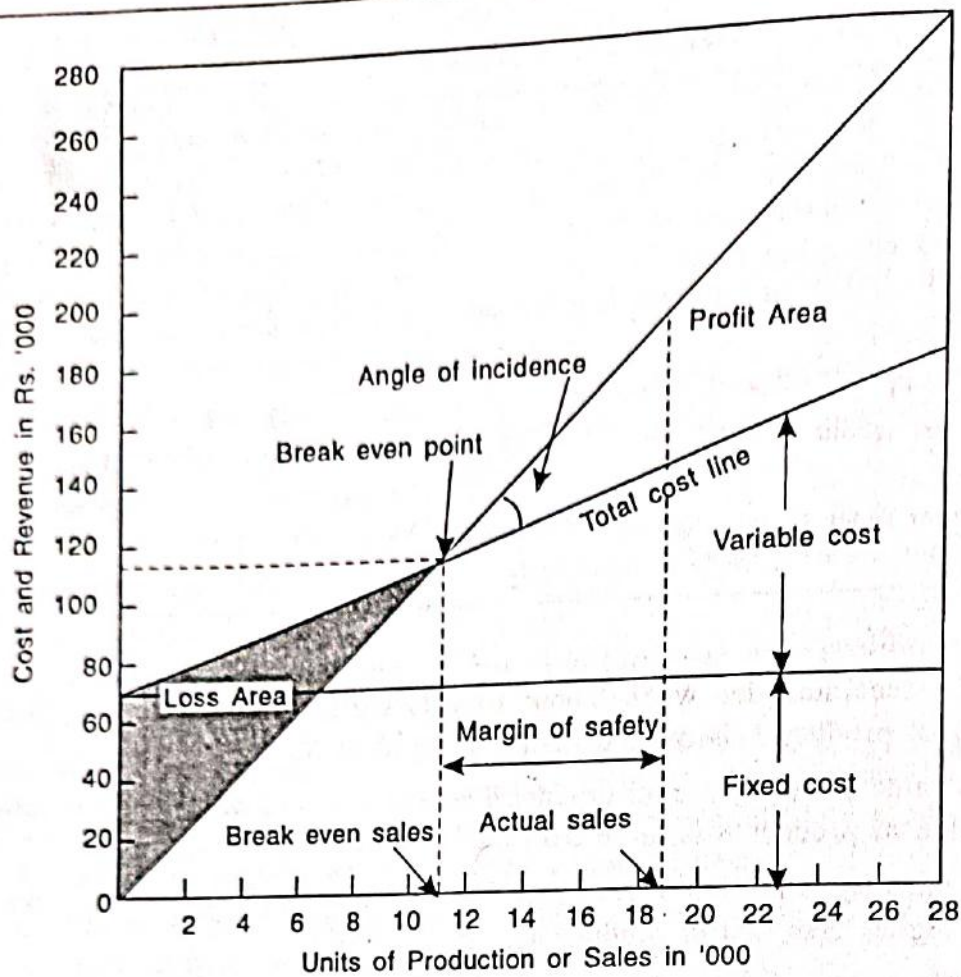


Fig. 5.2. Break-even Chart

Thus a break-even chart portrays the following information :

- (i) Break-even point – the point at which neither profit nor loss is made.
- (ii) The profit/loss at different levels of output.
- (iii) The relationship between variable cost, fixed cost and total cost.
- (iv) The margin of safety.
- (v) The angle of incidence, indicating the rate at which profit is being made.
- (vi) The amount of contribution at various levels of sales. (This can be shown only on a specially designed 'contribution break-even chart.')

Contribution Break-even Chart

This is an alternate form of break-even chart and shows the amount of contribution at different levels of output. In such charts variable cost is drawn first and fixed cost is super-imposed on the variable cost line. The space between total variable cost and sales line represents contribution. This is now shown in Fig. 6.6 with the figures of the above Illustration.

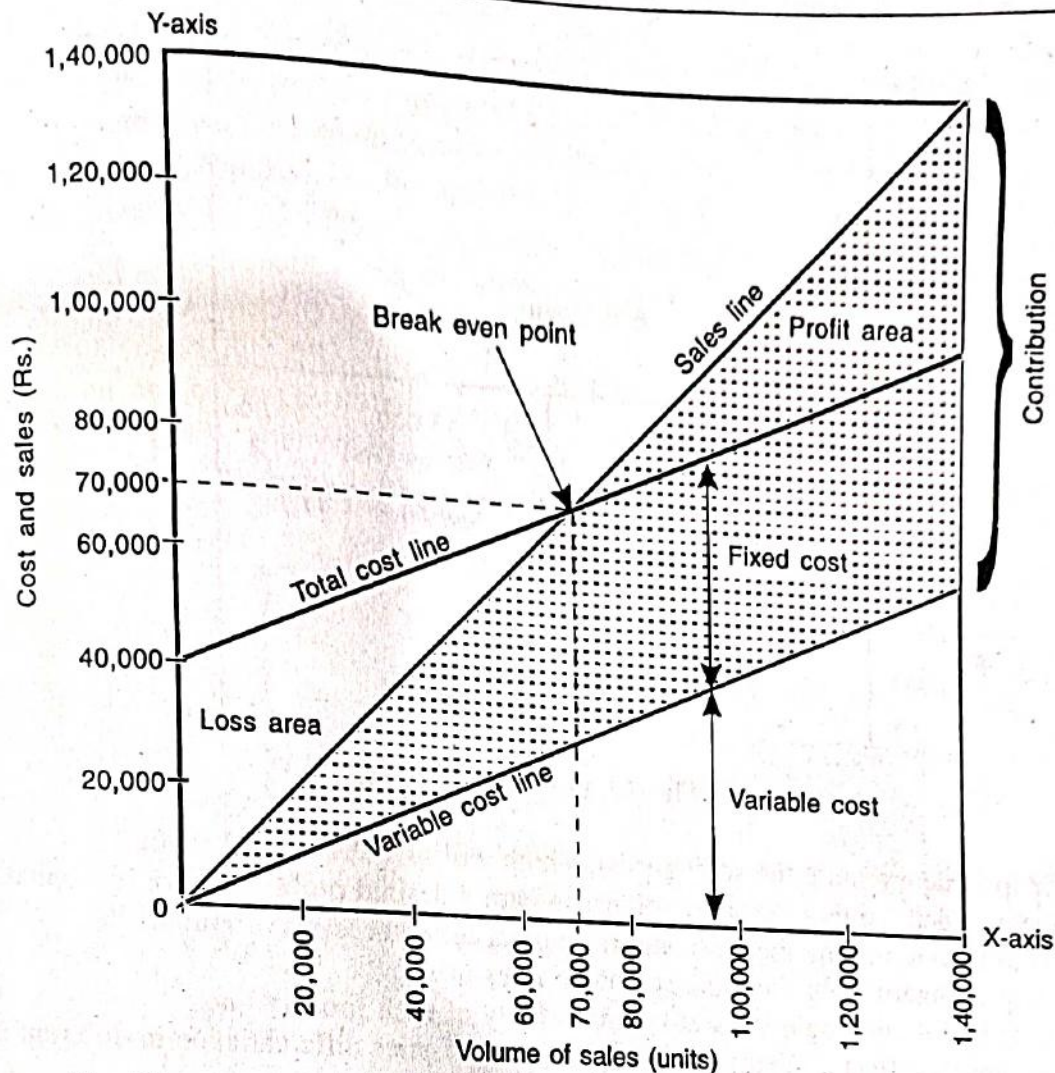


Fig. 5.3. Contribution Break-even Chart showing contribution as shaded area.

PROFIT-VOLUME CHART

The profit-volume chart or profit graph portrays the profit and loss at different levels of sales and is an alternative presentation of the facts illustrated in the break-even chart. Such a chart can be constructed from the same basic data from which a break-even chart can be drawn.

Example: Fixed cost Rs. 5,000
 Sales Rs. 20,000 (1000 units @ Rs. 20)
 Variable cost Rs. 10,000 (1000 units @ Rs. 10)

Calculations

$$\text{Profit-Volume ratio} = \frac{S - V}{S} = \frac{20,000 - 10,000}{20,000} \times 100 = 50\%$$

$$\text{Break-even point} = \frac{\text{Fixed cost}}{\text{P/V ratio}} = \frac{\text{Rs. 5,000}}{50\%} = \text{Rs. 10,000}$$

$$\text{Profits} = S - F - V = 20,000 - 5,000 - 10,000 = \text{Rs. 5,000}$$

Uses of Break-even Analysis

Some of the important uses of break-even analysis are summarised below :

1. It help in determining the break-even point.

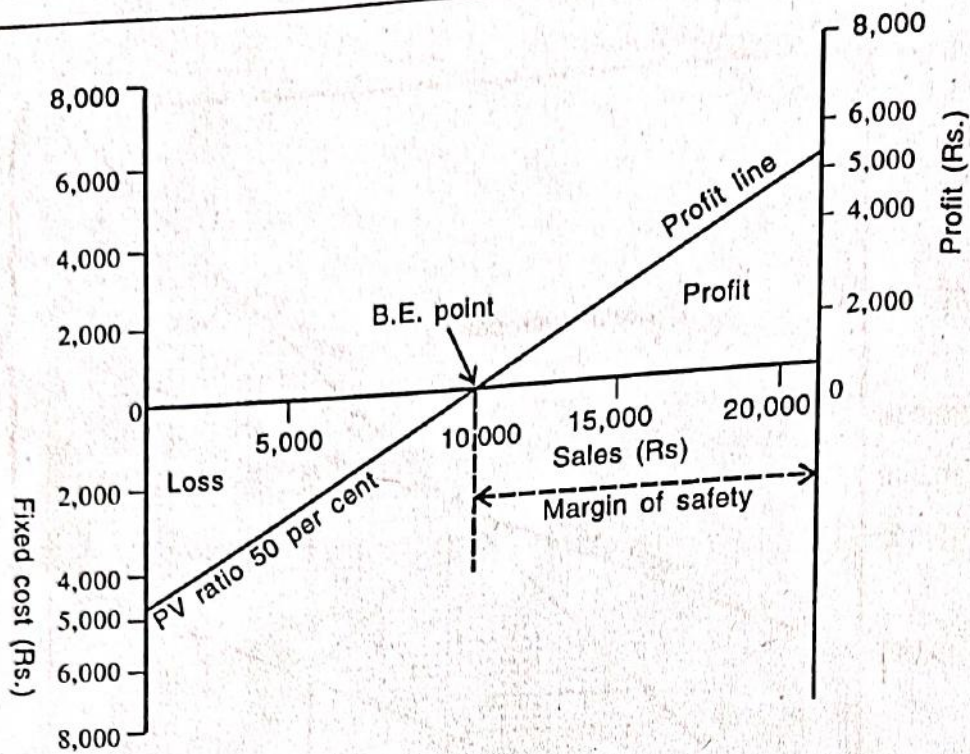


Fig. 5.4. Profit-volume Chart

2. It help in determining the selling price which will give the desired profit.
3. It help in determining the sales volume to earn a desired level of output.
4. It help in determining the costs and revenue at different levels of output.
5. It help in determining the most profitable sales mix.
6. It help in determining comparative profitability of each product line.
7. It studies the effect of change in selling price or of price differentiation in different markets, e.g., home market and foreign market.
8. It studies the impact of increase or decrease in fixed and variable costs on profits.
9. It studies the effect on profits and break-even points of high proportion of variable costs with low fixed cost and vice-versa.
10. It compares the profitability of various firms.
11. It helps in management decision-making, e.g., in make or buy decisions, discontinuance of a product line, acceptance of special job, etc.
12. It help in determining cash requirements at different levels of operation with the help of cash break-even charts.

Limitations of Break-even Analysis

Although break-even analysis is an invaluable tool of management, there are some limitations from which this technique suffers. These limitations of break-even analysis arise from certain assumptions on which the analysis is based and which are in effect, not true. Thus "break-even analysis is based on a simplified model of a business which is unrealistic." It "must be applied with an intelligent discrimination, with an adequate grasp of assumptions underlying the technique surrounding its practical applications." The assumptions of break-even analysis have already been narrated and now it is intended to study the unrealistic nature of these assumptions.

1. The assumption that all cost can be clearly separated into fixed and variable components is not possible to achieve accurately in practice, thereby resulting in inaccurate break-even analysis.

2. The assumption that variable cost per unit remains constant and that it gives a straight line chart is also not always true. In practice, many of the variable costs do not observe this tendency. Most of the variable costs, no doubt, move in sympathy with the volume of production but not necessarily in direct proportion to the volume.
3. Similarly, the assumption that fixed cost remains constant is also unrealistic. Fixed costs are constant only within a limited range of output and tend to increase by a sudden jump when additional plant and machinery is introduced.
4. The assumption regarding selling prices remaining unchanged as volume changes is also not true. In practice, selling prices do not remain fixed and change in prices affects demand. Any increase in output can be sold only by effecting a reduction in selling price which would effect the sales line.

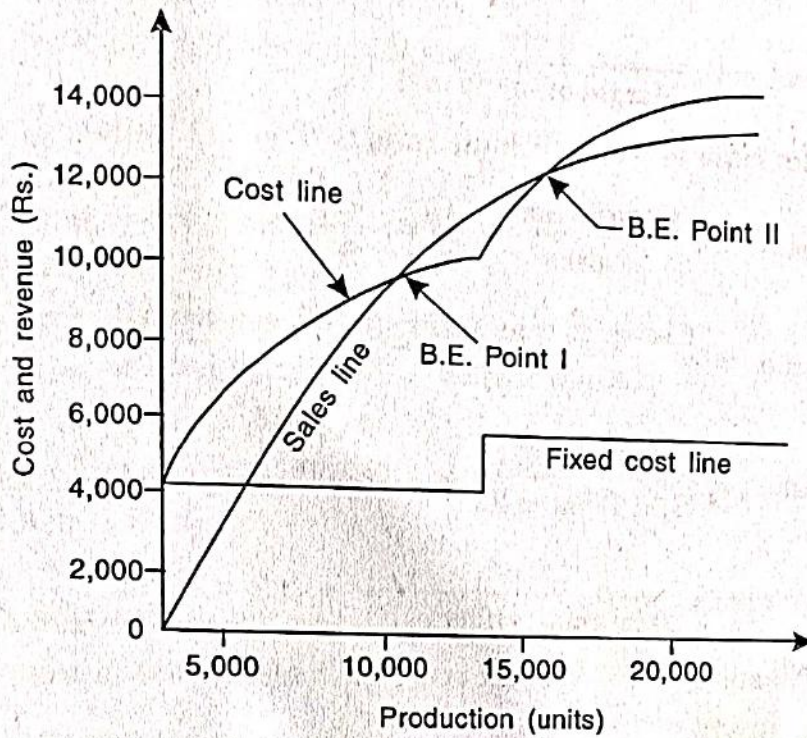


Fig. 5.5. Break-even chart with more than one break-even point showing that cost and sales lines in actual practice cannot be represented by straight lines.

5. The assumption that only one product is being produced or that product mix will remain unchanged is also not found in practice. The sales of various products manufactured is not always in predetermined proportion.
 6. It is assumed that production and sales are synchronised. This is not always so. Sales may fall short of production or may be capable of increase to match production only by effecting a reduction in selling prices.
 7. The break-even analysis completely ignores the consideration of capital employed which may be an important factor in the study of profit analysis.
- In spite of these limitations, break-even analysis is a very useful management device. It should be used by keeping in mind its limitations because then alone the technique can be used more effectively.

if u want to take any decisions like
as a mgr
→ in marginal cost we have only F.C and V.C there is no semi V.C

- Profit
- how to take decision
- how much sales are \uparrow
- when we are getting profit

6 APPLICATION OF MARGINAL COSTING

F.C + V.C

Introduction

The most valuable application of marginal costing is in management decision making. In any business, the basic function of management is to make decisions. Making decisions is to choose among two or more available alternatives. For example, the management may have to decide whether to raise the price of its product, lower it or leave it unchanged at its present level. It may have to decide whether to continue to sell its product at a loss in a falling market or shut down its operations for the time being. In a company, manufacturing television sets, the management may have to decide whether to make picture tubes within the company or to buy it from an outside supplier. Thus the management is continuously engaged in evaluating various alternatives and in selecting the best out of these. The decision to be taken will be affected by cost and other factors.

Short-term and Long-term Decisions

The focus of this chapter is on short-term decisions, such as :

- (i) Whether to sell a product in the domestic market or export it,
- (ii) Whether to make a component part inhouse or buy it from an outside supplier,
- (iii) Whether to change the present product mix to make it more profitable, etc.

Most managers consider a decision as a short-term if it involves a period of one year or less. This cut off period is arbitrary but commonly used, though a better distinction is that long term decisions normally require substantial capital investment with implications for several future years. Moreover, short-term decisions are more easily reversed than long-term. For example, price of a product can always be changed according to market conditions, export sales can be stopped, if necessary, and so on.

Long-term decisions involve consideration of return in capital employed, discounted cash flow, etc. Such decisions are outside the scope of this book.

Relevant Costs and Relevant Revenues

When management makes decisions, it has to concentrate on only relevant costs and relevant revenues. Not all costs and revenues are relevant. The relevant costs and relevant revenues are those expected future costs and expected future revenues that differ under different alternative courses of action being considered. Cost and revenues that remain unaffected by a decision are obviously irrelevant and need not be considered when making a decision.

Thus relevant costs and relevant revenues should have two characteristics :

- (a) The costs and revenues must relate to future, and
- (b) They must differ among different alternative courses of action.

The focus is on the future because decision to be made affects only future. Nothing can be done to change the past. Management cannot change the cost of plant and machinery purchased in 2001. It can change future costs by its current decisions. Hence, relevant costs are future costs that will differ depending on the actions of the management. In one decision a cost may be relevant but in another decision the same cost may not be relevant. For each decision, the management must decide which costs are relevant.

COST AND NON-COST FACTORS IN DECISION MAKING

In decision making, the management has to consider not only cost factors but also certain non-cost factors. Cost factors or quantitative factors are those which can be quantified in monetary terms. For example, in determining the selling price of a product, the cost of production of which is Rs. 100 per unit, the management will add, say 20% margin of profit and decide the selling price at Rs. $100 + 20 =$ Rs. 120 per unit. While the company is selling its product at Rs. 120 per unit, a competitor enters the market and starts selling the same product at Rs. 95 per unit. Now the company will incur a loss of Rs. 5 per unit if in order to compete, it sells the product at competitor's price because its own cost is Rs. 100 per unit. So, on cost considerations alone, the company should stop selling the product because selling results in a loss of Rs. 5 per unit. The management has to decide whether to sell at a loss or stop production of the product to avoid the loss.

In such a situation, it is difficult to make a decision on cost factors alone. It is essential that non-cost factors or qualitative factors be brought to the attention of the management in decision making process, since otherwise there is a danger of wrong decision being made. Non-cost factors are those which cannot be expressed in monetary terms with accuracy. For example, it may not be possible to quantify in monetary terms the effect of a decline in the morale of employees or loss of customer goodwill, if the company closes down the manufacturing facilities of a particular product.

Non-cost factors vary according to the decision under consideration. For example, a company plans to enter export business and it receives an export order at a price which is less than the own cost. On cost factors, the export order should be outrightly rejected because it does not cover even the cost. However, the management should consider the non-cost factors such as goodwill earned by the company for getting the export house status, earning valuable foreign exchange from the order and so on. For getting these benefits, the company should consider incurring a small and tolerable amount of loss, if it can afford it.

DECISION-MAKING AND MARGINAL COSTING

The most useful contribution of marginal costing is the assistance that it renders to the management in vital decision-making. This is to say that marginal costing is an invaluable aid to management decision-making. Specific areas where marginal costing proves its worth in decision-making are explained below:

1. Fixation of Selling Price

Although prices are regulated more by market conditions of demand and supply and other economic factors than by the decisions of management, the management while fixing prices has to keep in view the level of profit desired. In the long-run, the selling prices of products or services must be higher than the total cost as otherwise the profit cannot be earned. But frequently circumstances arise for management to

Application of Marginal Costing

6.3

consider special conditions and sell its regular product at a special price which may be lower than the total cost. Fixation of selling prices is discussed below :

- (a) Under normal circumstances.
- (b) In times of competition and/or trade depression.

Selling prices under normal circumstance

In the long run, under normal circumstances, the selling price must cover total cost (i.e., variable cost plus fixed cost) and also give a reasonable amount of profit. This is essential for the survival of a business.

In the short run due to adverse market conditions, the selling price may have to be fixed below total cost but it should be above variable cost. In other words, the selling price may be temporarily fixed at marginal cost plus contribution basis and the amount of contribution depends upon demand and supply, acuteness of competition, non-cost factors etc. But it should be noted that fixation of selling price below total cost may be made only on a short term basis.

Variable costing aids in decisions such as :

- Fixation of selling prices
- Exploring new markets
- Make or buy
- Product mix
- Operate plant or shut down.

Pricing in competition and depression

When there is acute competition or in periods of depression, products may have to be priced below total cost, if such a step is necessary to meet the special situation. When variable cost technique is used for pricing, the price should be higher than the variable cost so that it makes a contribution towards fixed cost and help reduce the loss. When price is just equal to variable cost, the amount of loss will also be equal to the amount of fixed cost because in such situations the selling prices make no contribution towards fixed cost.

Thus, under special circumstances like the trade depression or competition, if selling price is higher than variable cost, even though it is below total cost, the production should not be stopped. This is because fixed costs will have to be incurred irrespective of whether production is continued or not, and continuing the production will help in reducing the amount of loss.

As a note of caution, fixation of selling price below total cost should be made only on a short-term basis. Pricing based on variable cost plus contribution helps companies to take advantage of short-term opportunities. But at the same time, no firm can afford to incur loss on a long-term basis and thus in the long-run, the selling price must cover total cost and give a reasonable amount of profit.

Example

Fixed cost	Rs. 1,00,000 (total)
Variable cost	Rs. 7 per unit
Current market price	Rs. 8 per unit
Output	50,000 units.
Should company sell or not?	

Solution

Variable cost (50,000 units @ Rs. 7)	Rs. 3,50,000
Fixed cost	1,00,000
	<hr/>
Total cost	4,50,000

$$\text{Cost per unit} = \text{Rs. } 4,50,000 \div 50,000 \text{ units} = \text{Rs. } 9$$

Although the selling price does not cover the total cost, yet it is wise to continue to produce and sell because such a step will reduce the loss (on account of fixed cost) that will be incurred if production is stopped. If production is stopped, the loss would be Rs. 1,00,000 (the amount of fixed cost), but if production is continued the loss will be as follows:

Sales (50,000 units @ Rs. 8)	
Less: Total cost (Marginal cost + Fixed cost)	Rs. 4,00,000
	Rs. 4,50,000
Loss	<u>Rs. 50,000</u>

Thus, by continuing to produce and sell at below total cost, the loss is reduced by Rs. 50,000, i.e., from Rs. 1,00,000 to Rs. 50,000.

Special Circumstances when Selling Price is Below Variable Cost

When selling price falls below variable cost, the loss will be more than the amount of fixed cost. In such an eventuality, it will be better to stop production so as to reduce the amount of loss because stoppage in production means loss will be just equal to fixed cost.

However, in certain special circumstances like the following, production may be continued even if the selling price is below the marginal cost.

1. To popularise a new product. A new product introduced in the market may be sold at a very low price so as to make it popular.
2. To eliminate competitors from the market.
3. To dispose of perishable products so as to avoid total loss.
4. To export so as to earn foreign exchange. Government may allow import quota against foreign exchange earnings and profit from import quota may be more than the loss on exporting the product at low prices.
5. To keep plant and machinery in operation as idle machines may be liable to deterioration.
6. To prevent loss of future orders as temporary closure may break business connections with customers that can be re-established at a heavy expenditure.
7. To help in the sale of a conjoined product which is making large profits.
8. To maintain production and to keep employees occupied.

2 Exploring New Markets

Sometimes, a company is not able to fully utilise plant capacity when selling at total cost plus profit basis. In such a case, it may explore new markets and find opportunities to receive additional bulk order or export order at a price which may be below total cost but above variable cost so that the price makes a 'contribution'. The entire amount of contribution from such sales is profit because fixed cost is already recovered from current sales at total cost plus profit basis. Such additional sales at below total cost is possible only because in accepting bulk orders and export sales, price discrimination is possible. In this way spare plant capacity can be utilised to earn additional profit.

Additional Order for Utilising Spare Capacity

When a company has a spare (or idle) capacity which it is not able to utilise because of sales constraint and it receives a bulk order at below normal selling price, such an order should be accepted, provided existing sales are not affected by price discrimination. It will earn the company additional profit, by utilising spare capacity.

Illustration 6.1

A manufacturer of plastic buckets makes an average profit of Rs. 2.50 per piece on a selling price of Rs. 14.50 by producing and selling 60,000 pieces at 60% of potential capacity. His cost of sales is:

	Rs. per piece
Direct materials	4.00
Direct wages	1.00
Factory overhead (variable)	3.00
Selling overhead (variable)	0.25
Total fixed cost is Rs. 2,25,000	

During the current year, he intends to produce the same number of units, but anticipates that (a) fixed cost will go up by 10%, and (b) material and labour costs will go up by 5% each.

Under these circumstances, he obtains an offer for a further 20% of his capacity. What minimum price you would recommend for acceptance to ensure an overall profit of Rs. 1,60,000.

Solution

Budgeted Statement for the Current Year Prior to Acceptance of 20% Capacity Order

	Per piece Rs.	Total Rs.
Sales (60,000 pieces)	14.50	8,70,000
Direct material (Rs. 4 + 5%)	4.20	2,52,000
Direct labour (Rs. 1 + 5%)	1.05	63,000
Variable factory overhead	3.00	1,80,000
Variable selling overhead	0.25	15,000
Variable cost	8.50	5,10,000
Contribution (Sales – Variable cost)	6.00	3,60,000

Fixed cost Rs. 2,25,000 + 10%	= Rs. 2,47,500
Profit	= Contribution – Fixed cost
	= 3,60,000 – 2,47,500 = Rs. 1,12,500
Planned profit	= Rs. 1,60,000
Increase in profit (or contribution) required	= 1,60,000 – 1,12,500 = Rs. 47,500
Variable cost of additional 20,000 pieces (order for 20% capacity, i.e., 20,000 × Rs. 8.50)	Rs. 1,70,000
Add: Additional contribution desired	Rs. 47,500
Total sales value	<u>Rs. 2,17,500</u>

Selling price per unit = Rs. 2,17,500 ÷ 20,000 units = Rs. 10.875

Thus, minimum price for sale of additional 20,000 units is Rs. 10.875 so as to ensure an overall profit of Rs. 1,60,000.

Export Sales

Additional orders may be accepted from a foreign market at below normal price or below total cost but above marginal cost. Export sales yield additional contribution when such sales are at a price which is above variable cost.

- While determining profitability of accepting export orders, the following additional factors should be considered.
1. Export sales may result in additional costs like special packing cost, additional quality checks, freight and insurance charges, etc., if not borne by importer. These costs should be deducted from contribution to determine profit from export order.
 2. Export sales may result in certain cost benefits like export subsidy from government, exemption or concessions in excise duty or duty drawbacks, etc. In determining profit from export order, these items should be deducted from cost or added in contribution.

Illustration 6.2

Indo-British Company has a capacity to produce 5,000 articles but actually produces only 2,000 articles for home market at the following costs.

Materials		Rs.
Wages		40,000
Factory Overheads	— Fixed	36,000
	— Variable	12,000
Administration overhead	— Fixed	20,000
Selling and distribution overheads	— Fixed	18,000
	— Variable	10,000
		16,000
	Total Cost	1,52,000

The home market can consume only 2,000 articles at a selling price of Rs. 80 per article. An additional order for the supply of 3,000 articles is received from a foreign country at Rs. 65 article. Should this order be accepted or not, if execution of this order entails an additional packing cost of Rs. 3,000.

(M.Com. Kolkata, Adapted)

Solution

**Statement of Marginal Cost and Contribution
(of 3,000 articles for export)**

	Rs.
Materials @ Rs. 20 per article	60,000
Wages @ Rs. 18 per article	54,000
Variable overhead — Factory @ Rs. 10 per article	30,000
— Selling and dist. @ Rs. 8 per article	24,000
Marginal cost of sales	1,68,000
Sales (3,000 articles @ Rs. 65)	1,95,000
Contribution	27,000
	3,000
Additional profit	24,000
Less: Additional packing cost	

Acceptance of this export order results in additional profit of Rs. 24,000 and thus the order should be accepted.

Note: Fixed overhead have not been taken into account in deciding the acceptability of this order because fixed overhead have already been recovered from sale in the home market.

Non-Cost Factors or Qualitative Factors. Apart from cost and profit considerations, certain non-cost factors should also be kept in mind while making an exporting decision. These include :

- (a) Foreign exchange earnings.
- (b) Export house status.
- (c) Enhancement in company prestige and goodwill, etc.
- (d) Employment opportunities.

Conclusion

1. In normal times, prices should be based on total cost plus profit.
2. In market conditions like trade depression and competition, price may be fixed on marginal cost plus basis so as to make a contribution. This is valid only for a short period.
3. In order to utilise spare plant capacity, bulk orders from home market or from foreign market may be accepted at less than total cost but above marginal cost. This adds to the total profit of the company. This is possible only when price discrimination in such sales in different markets is possible.

3. Make or Buy Decisions (Insourcing Vs. Outsourcing)

Marginal cost analysis renders useful assistance when a decision has to be taken by the management on whether a component part should be manufactured internally or purchased from an outside firm. Insourcing is producing the goods by the firm itself whereas outsourcing is the process of purchasing the goods or services from outside suppliers. For example, a car manufacture may rely on outside vendors to supply some component parts but chooses to manufacture other parts internally.

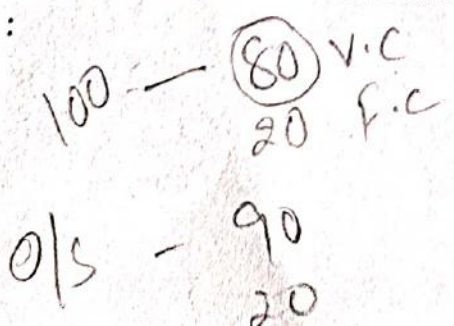
This is particularly so when a component part is available in the market at a price below firm's own total cost. This type of decision based on total cost analysis may be misleading. Such a decision can be arrived at by comparing the outside supplier's price with firm's own marginal cost. On the face of it, since the only cost to manufacture the component is its marginal cost, then the amount by which marginal cost falls below supplier's price is the saving that arises in making. Therefore, it will be profitable to buy from outside only when supplier's price is below firm's own marginal cost.

For example, total cost of making a component is Rs. 100 per unit, consisting of Rs. 80 as variable cost and Rs. 20 as fixed cost. Suppose, an outside firm is prepared to supply this component at Rs. 90, it may appear that it is cheaper to buy the component. But a study of cost analysis will show that each unit if manufactured makes a contribution of Rs. 20 towards recovery of fixed cost. This fixed cost has to be incurred whether we make or buy. The real cost of making the component part is only Rs. 80 which is its variable cost. This offer of Rs. 90 per unit should not be accepted because if accepted, the component will really cost Rs. 110, i.e., Rs. 90 of purchase price plus Rs. 20 of fixed cost which cannot be saved if component is not produced.

However, before arriving at final decision, due consideration should be given to other factors. For example, it should also be considered as to whether plant capacity released by the non-manufacture of the component part is put to some alternative use or not.

Illustration 6.3

A radio manufacturing co. finds that while it costs Rs. 6.25 to make component R-518, the same is available in the market at Rs. 5.75 each, with an assurance of continued supply. The break-down of the cost is :



	Rs.
Materials	2.75 each
Labour	1.75 each
Other variables	0.50 each
Depreciation and other fixed costs	1.25 each
	<u>6.25</u>

- (a) Should you make or buy ?
 (b) What would be your decision, if the supplier offered the component at Rs. 4.85 each ?
(I.C.W.A. Inter)

Solution.
 The variable cost of producing the component is shown below :

	Rs.
Materials	2.75
Labour	1.75
Other variable costs	<u>0.50</u>
Variable or Marginal cost	5.00
Fixed cost	<u>1.25</u>

On the face of it, it appears that it is cheaper to buy the component at Rs. 5.75 each because it is less than own cost of Rs. 6.25 each but it should be understood that the fixed costs cannot be saved if it is decided to buy the component instead of making it. Thus if the component is purchased then it will really cost Rs. 7 per component i.e. Rs. 5.75 paid for purchase plus Rs. 1.25 of fixed cost which will continue to be incurred and cannot be saved. It is therefore, advised to make the component. But decision to make or buy will be influenced by the fact whether the capacity to be released by the non-manufacture of the component can be put to some alternative use or not, resulting in a saving of fixed cost. If yes, buying will be preferable as the component which costs Rs. 6.25 is available at Rs. 5.75. But if the released capacity cannot be utilised, it should not be purchased but made by the firm.

(b) If the price offered is Rs. 4.85 per unit, then the offer can be accepted as there will be a saving of 15 paise per unit even if the capacity released cannot be profitably employed. This is so because the price offered is less than the variable cost of the product.

Outsourcing and Idle Capacity. When a firm has no spare capacity and manufacturing a component involves setting aside other work, the loss of contribution of displaced work should also be given due consideration. In other work, it will be profitable to buy only when the purchase price is below variable cost plus loss of contribution of displaced work. The loss of contribution is usually best found by the use of contribution per unit of key factor.

Illustration 6.4

Manufacture of product A takes 20 hours on machine No. 101. It has a selling price of Rs. 150 and marginal cost of Rs. 110. Component part Y could be made on machine No. 101 in 4 hours. The marginal cost of component part is Rs. 9 of which outside supplier's price is Rs. 15.

Should one make or buy component Y. Discuss in both situations when—

- (a) Machine No. 101 is working at full capacity.
 (b) There is idle capacity.

No 1 8668

Solution

(a) Contribution per unit of A = Rs. 150 - 110 = Rs. 40
 Contribution per machine hour = Rs. 40 ÷ 20 hrs = Rs. 2 per hour.

If component Y is manufactured then as it takes 4 hours, the loss of contribution is Rs. 8 (i.e., 4 hrs. @ Rs. 2).
 The total cost to make component Y will be Rs. 9 + Rs. 8 = Rs. 17.

This is more than supplier's price of Rs. 15 and so it is better to buy than to make component Y.

(b) If, however, there is some unutilised machine capacity, then there would be no loss of contribution and so the cost of making component Y would only be its variable cost, i.e., Rs. 9. In such a case, it would be economical to make the product than buy it.

Non-cost or Qualitative Factors. While making a decision on make or buy a component, the following non-cost factors should also be considered.

- (a) Assurance of continued supply, if bought from outside.
- (b) Assurance of quality of the product by the supplier.
- (c) Assurance of no price increase during the period of agreement.

4. Product Mix Decisions

Sales mix or product mix denotes the proportion in which various products are sold or produced. The problem of selecting a profitable mix of sales thus, arises only when a business enterprise has a variety of product lines and each making a contribution of its own. Any change in sales mix also results in the change in profit position. The technique of marginal costing helps the management in determining the most profitable sale mix.

The discussion on selection of the most profitable product mix may be discussed in two parts :

- (a) When there is no key factor, and
- (b) When there is a key factor.

(a) When there is no key (or limiting) factor

The concept of key factor was explained in the chapter on Cost Volume Profit Analysis. When there is no key factor, the product mix that provides the highest amount of *contribution* is considered as the most profitable sales mix. This holds good when fixed cost does not change due to changes in sales mix.

However, when changes in sales mix are associated with changes in fixed cost, then that sales mix which provides the highest *profit* is considered as the most profitable sales mix. In other words, relative profitability of mixes will be evaluated on the basis of their profit and not on the basis of their contribution when a change in product mix is associated with change in fixed cost.

Illustration 6.5

The following production/sales mix are capable of achievement in a factory:

- (i) 2,000 units of product A and 2,000 units of product C.
- (ii) 4,000 units of product B.
- (iii) 1,000 units of product A, 2,000 units of product B and 1,600 units of product C.

Cost per unit is as follows:

	A	B	C
Direct materials Rs.	20	16	40
Direct wages Rs.	8	10	20

Fixed cost is Rs 20,000 and variable overheads per unit of A, B and C are Rs. 2, Rs. 4 and Rs. 8 respectively. Selling prices of A, B and C are Rs. 36, Rs. 40 and Rs. 100 per unit respectively.

Determine the marginal contribution per unit of A, B and C and the profits resulting from product mixes (i), (ii) and (iii).



6.10
Solution

Marginal Cost Statement

	Per unit of products		
	A Rs.	B Rs.	C Rs.
Selling price (S)	36	40	100
Direct material	20	16	40
Direct wages	8	10	20
Variable overhead	2	4	8
Variable cost (V)	30	30	68
Contribution (S - V)	6	10	32

Statement Showing Comparative Profitability

Sales	Contribution	Total contribution	Fixed cost	Profit
(i) A 2,000 units	12,000 2000×6			
C 2,000 units	64,000 2000×32	76,000	20,000	56,000
(ii) B 4,000 units	40,000 4000×10	40,000	20,000	20,000
(iii) A 1,000 units	6,000 1000×6			
B 2,000 units	20,000 2000×10			
C 1,600 units	51,200 1600×32	77,200	20,000	57,200

Conclusion. The sales mix (iii) is the most profitable as it yields the highest amount of contribution and profit.

(b) When there is a key factor

When a key factor is operating, selection of the most profitable sales mix is based on contribution per unit of key factor. The product which makes the highest amount of contribution per unit of key factor, is the most profitable one and its production is pushed up. The second preference is to be given to product which yields the second highest contribution per unit of key factor and so on and in the end that product should be produced which yields least contribution per unit of key factor and to the extent of availability of the key factor.

In case a number of key factors are operating simultaneously, the basic principle remains the same but problem becomes more mathematical in nature and one has to resort to Linear Programming to determine the optimal product mix.

Illustration 6.6

A company manufactures three products. The budgeted quantity, selling prices and unit costs are as under :

	A	B	C
Raw materials (@ Rs. 20 per kg)	Rs. 80	Rs. 40	Rs. 20
Direct wages (@ Rs. 5 per hour)	5	15	10

Application of Marginal Costing

6.11

Variable overheads	10	30	20
Fixed overheads	9	22	18
Budgeted production (in units)	6,400	3,200	2,400
Selling price per unit (in Rs.)	140	120	90

Required :

(i) Present a statement of budgeted profit.

(ii) Set optimal product-mix and determine the profit, if the supply of raw materials is restricted to 18,400 kg.

Solution

(i) Statement of Budgeted Profit

	A	B	C	Total Rs.
Budgeted production (units)	6,400	3,200	2,400	
Selling price Rs.	140	120	90	
Sales (S)	8,96,000	3,84,000	2,16,000	14,96,000
Raw materials	5,12,000	1,28,000	48,000	
Direct wages	32,000	48,000	24,000	
Variable overhead	64,000	96,000	48,000	
Total variable cost (V)	6,08,000	2,72,000	1,20,000	10,00,000
Contribution (S - V)	2,88,000	1,12,000	96,000	4,96,000
Less: fixed cost*				1,71,200
Profit				3,24,800

*Calculation of Fixed Cost

A = 6,400 unit × Rs. 9	=	Rs. 57,600
B = 3,200 units × Rs. 22		70,400
C = 2,400 units × Rs. 18		43,200
Total fixed cost	=	<u>Rs. 1,71,200</u>

(ii) When raw material is the key factor

	A	B	C
Raw material per unit of output	4 kg	2 kg	1 kg
Total raw material consumed (kg)	6400 × 4 = 25,600	3200 × 2 = 6,400	2400 × 1 = 2,400
*Contribution per kg of raw material	= $\frac{\text{Rs. } 2,88,000}{25,600 \text{ kg.}}$ = Rs. 11.25	= $\frac{\text{Rs. } 1,12,000}{6,400 \text{ kg.}}$ = Rs. 17.50	= $\frac{\text{Rs. } 96,000}{2,400 \text{ kg.}}$ = Rs. 40
Ranks	III	II	I

*Contribution per kg of raw material is calculated as :

Total contribution ÷ Total raw materials consumed

Suggested sales mix (raw material is the key factor)

Rank I - Product C - 2,400 units × 1 kg

Rank II - Product B - 3,200 units × 2 kg

Rank III - Product A - 2,400 units × 4 kg (balance)

Total materials available

$2,400 \text{ kg} + 6,400 \text{ kg} + 9,600 \text{ kg} = 18,400 \text{ kg}$
 $8800 - 18400 = 9,600$

Thus the suggested product mix is : A - 2,400 units, B 3,200 units and C - 2,400 units

Calculation of Profit

Product		Contribution
A	2,400 units @ Rs. 45 p.u.	Rs. 1,08,000
B	3,200 units @ Rs. 35 p.u.	Rs. 1,12,000
C	2,400 units @ Rs. 40 p.u.	<u>Rs. 96,000</u>
Total contribution		3,16,000
Less: Total fixed cost		<u>1,71,200</u>
Profit		<u><u>Rs. 1,44,800</u></u>

$$\frac{2,88,000}{6400} = 45$$

5. Plant Shut Down Decisions

The management under certain circumstances might feel that plant shut down, i.e., closing down the business, is better than operating at a loss. However, variable costing analysis may prove that this is not always so. This type of situation usually arises when sufficient sales cannot be achieved.

This type of decision may be either (a) temporary suspension of production activities, or (b) permanent closing down of production.

Temporary Closing Down. Temporary suspension of activities is a short-term measure. The object is usually to stop operations until trade depression has passed. The question before management is: when should operations be suspended? or in other words, how long should operations be continued? The answer to this question is that if products are making a contribution towards fixed cost, then generally speaking, production should not be suspended. This is so because continuing production will help minimising loss which would be incurred if plant is shut down. Thus, the information needed to solve this type of problem involves a comparison between probable loss at a given level of output and the loss that would be suffered if production is suspended temporarily.

Example: A manufacturing company supplies you the following information:

Normal capacity of plant	10,000 units
Fixed cost	Rs. 1,00,000
Marginal cost per unit	Rs. 75
Estimated selling price	Rs. 80
Estimated sales volume at this selling price	5,000 units

Marginal Cost Statement

Total sales (5,000 units × Rs. 80)	4,00,000
Less: Marginal cost (5,000 units × Rs. 75)	<u>3,75,000</u>
Contribution	25,000
Fixed cost	<u>1,00,000</u>
Loss	<u><u>(-) 75,000</u></u>

If plant is shut down, the loss due to fixed cost would be Rs. 1,00,000. However, if plant is operated, the loss would only be Rs. 75,000. This is because selling price is above the marginal cost and is making a contribution towards fixed cost.

Role of Committed and Discretionary Fixed Costs. Sometimes, certain fixed costs can be avoided by management when plant is not operative. These are termed as discretionary fixed costs. Committed fixed costs, on the other hand, are those that cannot be avoided even if production is discontinued.