

## UNIT – 2

### PRODUCTION AND COST ANALYSIS

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**Production:** Production is the process of transformation of inputs into goods & services for consumer utilization. It is a technological relationship b/w physical inputs and physical outputs over a given period of time.

**Production Function:**

According to Samuelson, *The technical relationship which reveals the maximum amount of output capable of being produced by each and every set of inputs.*

Acc. to Michael R Baye, *That function which defines the maximum amount of output that can be produced with a given set of inputs.*

Production Function defines the engineering relationship between inputs and outputs given the technological know-how.

The inputs for any product / service are land, labour, capital, organisation & Technology.

Mathematically, production function can be written as,

$$Q = f\{L1, L2, C, O, T\}$$

where,

Q = Production / output Quantity

f= production function

L1= Labour

L2= Land

C= Capital

O= Organisation

T = Technology.

A producer / manufacture has to make a choice of production function by considering his technical knowledge, the process of various factors of production and his efficiency levels to manage.

**Types of Production Functions:**

- 1) Production Function with one variable / Law of diminishing / Law of variable proportions.
- 2) Production function with two variables.
- 3) Production function with multiple variables

## **PRODUCTION FUNCTION WITH ONE VARIABLE / LAW OF DIMINISHING / LAW OF VARIABLE PROPORTIONS.**

In short - run, production shows the maximum output of a firm can produce when only one input can be varied. Here, production function becomes,

$$Q = f\{L^1\}$$

Acc. to Benham, "as proportion of one factor in a combination of factors is increased, after a point, first the marginal, then the average product of that factor will diminish".

where the one factor of production is introducing in production process increasing manner, the total output in the initial stage will increase at an increasing rate, and after reaching certain level, the total output will be in declining rate. this law is universal in nature. it proved to be that in agriculture and industry also.

Number of workers (L)	Total output (TP) (thousands per year) (Q)	Marginal product ( $MP_t = \Delta Q / \Delta L$ )	Average product ( $AP_t = Q/L$ )
0	0	—	—
1	10	10	10
2	28	18	14
3	54	26	18
4	76	22	19
5	90	14	18
6	96	6	16
7	96	0	13.5
8	92	-4	11.5

Total Production (TP) is total no. of units produced in a given period of time. Marginal Production(MP) is the additional production by introducing additional unit of labor. Average Production (AP) is total production / no.of units.

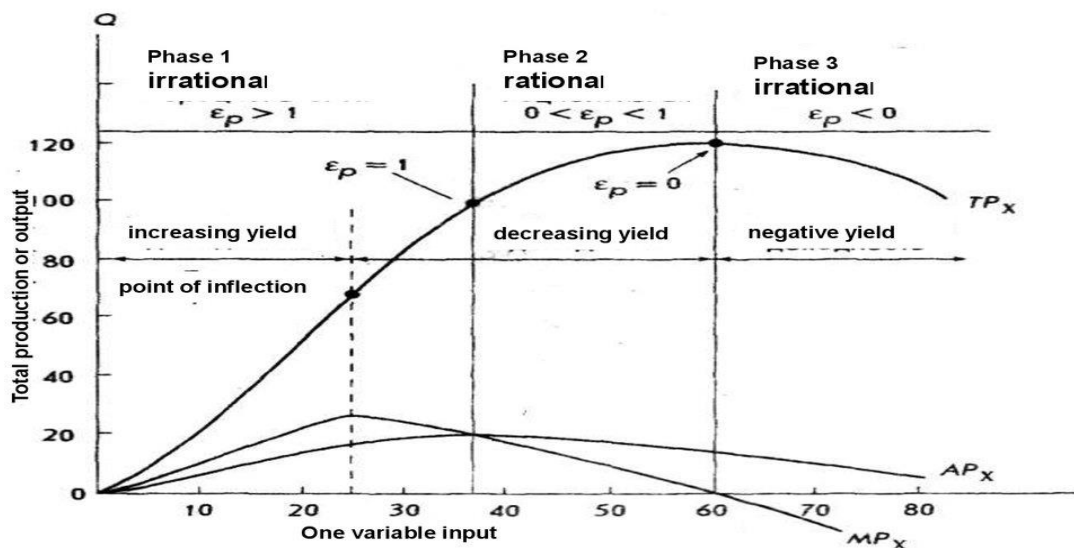


Рис. 10.1. Соотношения производственной функции

In short run, it is assumed that, only the labor factor is available variable input. the firm starts production with a fixed amount of capital and uses more and more unit of labor. In the initial stages the productivity was increased up to Phase -1. Where the more units of labour is used output increases up to Phase - 3. After phase -3 the total output declines and the MP is negative. this indicates that the additional units of labour are not contributing anything positively to the TP. Even if labour avail at free of cost is not worth using it

### PRODUCTION FUNCTION WITH TWO VARIABLES

Consider the production process requires two inputs, Capital(C) & Labour (L) to produce a given output (Q). There could be more than two inputs in real life situations. To understanding in easy manner, restrict the no. Of inputs to two only, to some extent these two inputs are substituted each other.

$$Q = f \{ C, L \}$$

#### Isoquants:

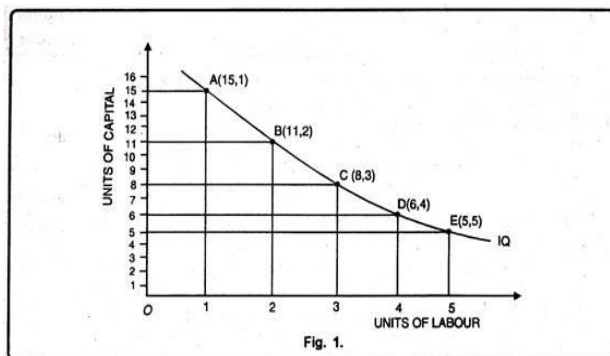
Isoquants, which are also called equal product curves, are similar to the indifference curves of the theory of consumer's behaviour. An isoquant represents all those factor combinations which are capable of producing the same level of output.

The Iso quants are thus contour lines which trace the loci of equal outputs. Since an iso quant represents those combinations of inputs which will be ca-

pable of producing an equal quantity of output, the producer would be indifferent between them. Therefore, Iso quants are also often called equal product curves production-indifference curves.

Combination	Labour (units)	Capital (Rs.)	Output (units)
A	15	1	150
B	11	2	150
C	8	3	150
D	6	4	150
E	5	5	150

The above table shows that combination A shows that 20 units of labour and One Lacks Rupees of capital yields 150 units of output. all other combinations in the table shows the same output say 150 units by employing any one of alternative combinations of the two factors. Iso product curve shown as below.



On X- axis labour & on Y-axis Capital is represented. Isoquant curve shows all alternative combinations A,B,C. D & E which can produce same quantity i.e., 150 units.

### Features of Iso Quant:

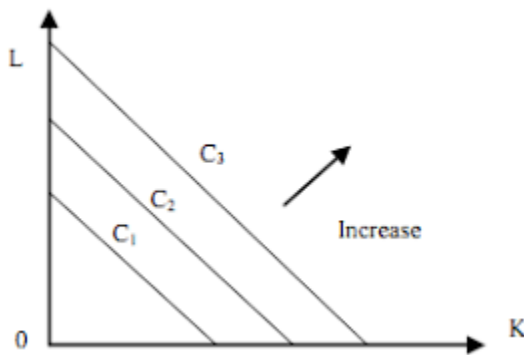
Iso quant curves are having the following features.

- **Downward sloping** - Iso quant curves are downward sloping curves. because if one input increases, the other input reduces. There is no question of increase in both the inputs to yield a given output. Since both inputs are having inverse isoquant slopes downward from left to right.
- **Convex to Origin** - Isoquants are convex to the origin. it is because, the input factors are not perfect substitutes. One input factor can be substituted by other input factor in a diminishing marginal rate. if the input factors are perfect substitutes, the isoquant would be a falling straight-line. when the inputs are used in fixed proportions and substitutions of one inputs for the other can't take place so isoquant will be L-shape.

- **Do not touch axis:** the isoquant curve touches neither X-axis or Y- axis.
- **Do not intersect:** Two Iso-products don't intersect with each other. it is because each of these denote a particular level of output.

### ISOCOSTS:

It refers to that cost curve represents the combination of inputs that will cost the producer to the same amount of money. In other words, each isoquant curve denotes a particular level of total cost for a given level of production. If the level of production changes, the total cost changes and thus Iso cost curves moves upwards and vice-versa.



In the given figure shows that the 3 downward sloping straight cost curves, each costing (C1,C2&C3) for the different output levels. Isocosts further from the origin, for the given input costs are associated with higher costs. Any change in input prices changes the slope of Isocost lines.

### Marginal Rate of Technical Substitution (MRTS) :

The marginal rate of technical substitution (MRTS) is an economic theory that illustrates the rate at which one factor must decrease so that the same level of productivity can be maintained when another factor is increased.

$$MRTS_L^K = \frac{dL}{dK} = \frac{MP_L}{MP_K}$$

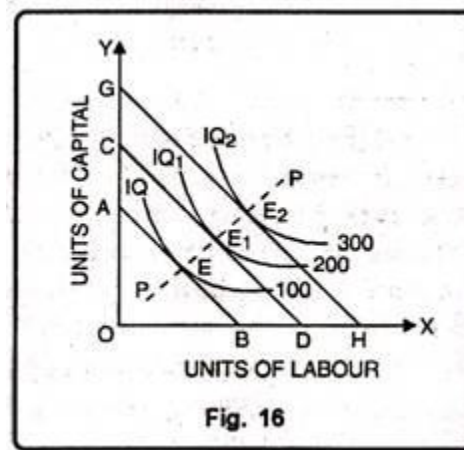
Table-5: MRTS of L for K				
Combination	Input L	Input K	Output	MRTS of L for K
P	1	15	150	
Q	2	11	150	4:1
R	3	8	150	3:1
S	4	6	150	2:1
T	5	5	150	1:1

The MRTS is the slope of a graph with one factor represented on each axis. The MRTS slope is an [isoquant](#) or a curve that connects the two input points as long as the output remains the same.

For example, an MRTS graph that has capital (represented with K on its Y-axis and labor (represented with L) on its X-axis is calculated as  $dL / dK$ . The isoquant shape is dependent upon whether input values are exact substitutes, which results in a straight line, or complements, which creates an L shape. When input values are not exact substitutes, the line is curved.

### **LEAST COST COMBINATION OF INPUTS:**

The manufacturer has to produce at lower to attain higher profits. Both Isoquant and Isocosts can be used to determine the input usage that minimizes the cost of production. where the slope of isoquant is equal to iso cost their lies the lowest point of cost of production. This can be observed by super imposing the Isocosts on Iso product curves.



It is evident that the producer can with a total outlay C, reach the Highest Isoquant curve which is D. If he wants to reach IQ2, he has to bring additional resources, which is let us prices are given. The expansion path PP is also known scale line as it indicates how to adjust the scale of operations as the firm changes its output.

## **Cobb-Douglas Production Function**

In 1928, **Charles Cobb** and **Paul Douglas** presented the view that production output is the result of the amount of labor and physical capital invested. This analysis produced a calculation that is still in use today, largely because of its accuracy.

The **Cobb-Douglas production function** reflects the relationships between its inputs - namely physical capital and labor - and the amount of output produced. It's a means for calculating the impact of changes in the inputs, the relevant efficiencies, and the yields of a production activity. Here's the basic form of the Cobb-Douglas production function:

$$Q(L, K) = A * L^{\beta} * K^{\alpha}$$

In this formula,  $Q$  is the quantity produced from the inputs  $L$  and  $K$ .  $L$  is the amount of labor expended, which is typically expressed in hours.  $K$  represents the amount of physical capital input, such as the number of hours for a particular machine, operation, or perhaps factory.  $A$ , which appears as a lower case  $b$  in some versions of this formula, represents the **total factor productivity (TFP)** that measures the change in output that isn't the result of the inputs. Typically, this change in TFP is the result of an improvement in efficiency or technology. The Greek characters *alpha* and *beta* reflect the output elasticity of the inputs. **Output elasticity** is the change in the output that results from a change in either labor or physical capital.

For example, if the output elasticity for physical capital ( $K$ ) is 0.60 and  $K$  is increased by 20 percent, then output increases by 3 percent ( $0.6/0.2$ ). The same is true for the output elasticity of labor: an increase of 10 percent in  $L$  with an output elasticity of 0.40 increases the output by 4 percent ( $0.4/0.1$ ).

## **Leontief Production Function**

In [economics](#), the Leontief production function or fixed proportions production function is a [production function](#) that implies the [factors of production](#) will be used in fixed (technologically pre-determined) proportions, as there is no [substitutability](#) between factors. It was named after [Wassily Leontief](#) and represents a [limiting case](#) of the [constant elasticity of substitution](#) production function.

For the simple case of a good that is produced with two inputs, the function is of the form

$$q = \min [Z_1/a, Z_2/b]$$

where  $q$  is the quantity of output produced,  $z_1$  and  $z_2$  are the utilized quantities of input 1 and input 2 respectively, and  $a$  and  $b$  are technologically determined constants.

## **Returns to Scale**

The concept of returns to scale arises in the context of a firm's [production function](#). It explains the long run linkage of the rate of increase in output (production) relative to associated increases in the inputs ([factors of production](#)). In the long run, all factors of production are variable and subject to change in response to a given increase in production scale.

There are three possible types of returns to scale:

- ✓ Increasing returns to scale
- ✓ Constant returns to scale, and
- ✓ Diminishing (or decreasing) returns to scale.

If output increases by more than the proportional change in all inputs, there are [increasing returns to scale](#) (IRS).

If output increases by the same proportional change as all inputs change then there are [constant returns to scale](#) (CRS).

If output increases by less than that proportional change in all inputs, there are [decreasing returns to scale](#) (DRS).

Returns to Scale can be explained through the following table:

Capital (Rs.)	Labour (units)	% of increase in	Output (units)	% of increase in	Laws of applicable
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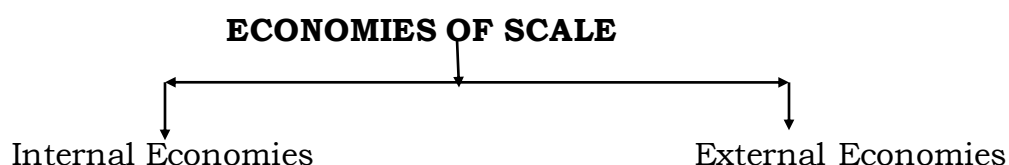


		<b>both inputs</b>		<b>output</b>	
1	3	-	50	-	-
2	6	100%	120	140 %	IRS
4	12	100%	240	100%	CRS
8	24	100%	360	50%	DRS

A firm's production function could exhibit different types of returns to scale in different ranges of output. Typically, there could be increasing returns at relatively low output levels, decreasing returns at relatively high output levels, and constant returns at some range of output levels between those extremes.

### **ECONOMIES TO SCALE**

Production may be carried on a small scale or large scale by a firm. When a firm expands its size of production by increasing all the factors it secures certain advantages known as economies of production. Marshall has classified these economies of large scale production into internal and external economies.



**Internal Economies** refers to the economies in production costs which accrue to the firm alone when it expands its output. This can be explained in the following ways:

- a) **Managerial Economies:** As the firm expands its operations, needs qualified managerial personnel to handle each of its functions - Marketing, Finance, Production, HR and other in a professional way. Functional specialization ensures minimum wastage and lowest the cost of the production in the long run.
- b) **Commercial Economies:** The transactions of buying & selling of Raw - materials and other operating supplies such as spares and so on will be rapid and the volume of each transaction also grows as the firm growing. There could be savings in procurement, transportation and storage cost leads to lowest cost, that increase profits
- c) **Financial Economies:** There could be cheaper credit facilities from the financial institutions to mute the capital expenditure and working capital needs. A larger firm has more assets gives security to the financial institutions which can consider reducing the rate of interest on the loans.

- d) **Technical Economies:** Increase in the scale of production follows when there is sophisticated technology available and firm is in a position to hire qualified technical manpower to make use of them. there could be substantial savings in their hiring due to larger investment in the technology. This lowers cost per unit substantially.
- e) **Marketing Economies:** As the firm is growing it can afford to maintain a full-fledged marketing department. To handle the issues related to design of customer surveys advertising materials, promotion campaign, handling of sales and marketing staff, renting of hoardings, launching of new product and so on.
- f) **Risk - Bearing Economies:** As the firm increases its size there is increase in the risk also. Sharing the risk with the insurance companies is the first priority for any firm. The firm can insure its machinery and other assets against the hazards of fire, theft, and other risks. The large firm can spread their risk so that they do not keep all their eggs in single basket.
- g) **Invisibilities & Automated Machinery:** To manufacture goods, a plant of certain minimum capacity is required whether the firm would like to produce and sell at the full capacity or not.  
for ex: In a business firm requires a telephone, a manager, an accountant, and a typist just because the production is lesser, the firm cannot hire half the manager or half the telephone likewise with a given plant certain minimum quantity to be produced.
- h) **Economies of Research and Development:** Large organizations such as Dr. Reddy's Lab, Hindustan Lever spend heavily on research and development and bring out several innovative products. Only such firms with a strong R&D base can cope with competition globally.

**External Economies** refers to all the firms in the industry because of the growth of industry as a whole or because of growth of ancillary industries.

Business firm enjoys a no. of external economies as,

- a) **Economies of Information:** The industry can setup an information centre which may publish a journal and pass on information regarding availability of Raw-materials, modern machinery, export opportunities and provide other information needed by firms. it will benefit all firms and reduction in their costs.
- b) **Economies of Welfare:** An industry is in a better position to provide welfare facilities to the workers. It may get land at a concessional rates and procure special facilities from the local bodies for setting up housing societies for the workers. It also establish public healthcare

units, educational institutions both general and technical. so that continuous supply of skilled labour available to the industry.

- c) **Economies of Concentration:** when an industry is concentrated in a particular area all the member firms reap some common economies like skilled labour improved means of transport, banking and financial services, communications, supply of power and benefit from the subsidies. All these facilities tend to lower the unit cost of production of all the firms in industry.
- d) **Economies of R&D:** All the firm can hold the resources together finance research and development activities and thus share the benefits of research. They could be a common share journals, news papers and other valuable reference material of common interest.

## **COST ANALYSIS**

Cost refers to the expenditure incurred to produce a particular product or service.

The cost of production normally includes the cost of raw-materials, labour, and other expenses. This cost is known as total cost (TC). This is compared with total revenue (TR) realized on the sale of the products manufactured. the difference between TR & TC is termed as Profit. ( $P = TR - TC$ ). This is financial accountants interpretation of total cost, total revenue and profit. This may provide a valid base to serve legal purpose.

A managerial Economist must have a clear understanding of different cost concepts for clear business thinking and proper application. These cost concepts needed in decision making. The various relevant concepts are;

### **1) Long & Short Run Cost:**

Long-run costs are those which vary with output when all inputs are variable including plant and capital equipment. Long-run cost analysis helps to take investment decisions.

Short-run Cost is the cost which has short-term implications in the production process, i.e. these are used over a short range of output. These are the cost incurred once and cannot be used again and again, such as payment of wages, cost of raw materials, etc.

### **2) Fixed Costs & Variable Costs:**

Fixed costs are those which do not change with the volume of output. The business incurs them regardless of their level of production. Examples of these include payment of rent, taxes, interest on a loan, etc.

Variable costs are costs which will vary depending upon the output that the business generates. Less production will cost fewer expenses, and vice versa, the business will pay more when its production is greater. Expenses on the purchase of raw material and payment of wages are examples of variable costs.

- 3) **Marginal Cost** is the change in the total cost that arises when the quantity produced is incremented by one unit; that is, it is the cost of producing one more unit of a good.

- 4) **Controllable & Uncontrollable Cost:**

Controllable Cost is an expense that can be increased or decreased based on a particular business decision whereas uncontrollable cost is a cost that cannot be increased or decreased based on a business decision.

- 5) **Outlay costs and Opportunity costs:**

The actual expenses incurred by the entrepreneur in employing inputs are called outlay costs. These include costs on payment of wages, rent, electricity or fuel charges, raw materials, etc. We have to treat them as general expenses for the business.

Opportunity costs are incomes from the next best alternative that is foregone when the entrepreneur makes certain choices.

For example, the entrepreneur could have earned a salary had he worked for others instead of spending time on his own business. These costs calculate the missed opportunity and calculate income that we can earn by following some other policy.

- 6) **Incremental Costs & Sunk Costs :**

Incremental costs are incurred when the business makes a policy decision. For example, change of product line, acquisition of new customers, upgrade of machinery to increase output are incremental costs.

Sunk costs are costs which the entrepreneur has already incurred and he cannot recover them again now. These include money spent on advertising, conducting research, and acquiring machinery.

7) **Implicit & Explicit Cost:**

Implicit Costs are opportunity costs, while explicit costs are expenses paid with a company's own tangible assets. This makes implicit costs synonymous with imputed costs, while explicit costs are considered out-of-pocket expenses.

8) **Historical & Replacement cost :**

Historical cost of an asset refers to the actual cost incurred at the time the asset was acquired. In contrast, the replacement cost stands for the cost which must be incurred if the asset is to be purchased today. The two concepts differ due to price variations over time.

9) **Avoidable & Unavoidable Cost:** Avoidable cost is a cost that can be excluded due to stoppage of conducting a business activity. Unavoidable cost is a cost that is continued to incur even if the activity is not performed.

10) **Accounting cost & Economic Cost:**

Accounting costs are those for which the entrepreneur pays direct cash for procuring resources for production. These include costs of the price paid for raw materials and machines, wages paid to workers, electricity charges, the cost incurred in hiring or purchasing a building or plot, etc. Accounting costs are treated as expenses. Chartered accountants record them in financial statements.

Economic costs - There are certain costs that accounting costs disregard. These include money which the entrepreneur forgoes but would have earned had he invested his time, efforts and investments in other ventures. For example, the entrepreneur would have earned an income had he sold his services to others instead of working on his own business

Similarly, potential returns on the capital he employed in his business instead of giving it to others, the output generated by his resources which he could have used for others' benefits, etc. are other examples of economic costs.

## **BREAK - EVEN ANALYSIS**

The success of a business is measured in terms of the profit. The profit of any firm depends on three elements namely;

- 1) Cost of production,

- 2) Selling Price,
- 3) Volume of Sales.

These three factors are independent. Cost determines the selling price. The selling price affects the volume of sales. The volume of sales influences the volume of production. This volume of production in turn affects the cost. Thus, an analysis of relationship between cost, volume and profits helps the management for profit planning.

The study of cost - volume - profit (CVP) analysis is popularly known as Break - Even Analysis. It is an extension of marginal costing principles. the CVP analysis is a management tool to show the relationship between these ingredients of profit planning.

Break - Even Analysis is used in two senses namely narrow sense and Broad sense. In a narrow sense it means finding break - even point i.e., no profit or no loss point. At Break - Even point total sales are equal to total costs. Thus, there is neither profit nor loss. In broad sense Break - Even Analysis refers the relationship between costs, volume and profit at different levels of sales or operations.

### **BREAK - EVEN POINT:**

*Break - Even point is a point where the total sales are equal to total cost. it is a point of no profit no loss.* At this point the income of the business is exactly equal to its expenditure. At this point contribution is equal to the fixed costs.

The Break - Even point can be determined by the following methods.

- 1) Algebraic Formula Method,
- 2) Graphic Or Chart Method.

#### **Algebraic Method**

$$\text{Break -Even Point(BEP)} = \text{Fixed cost} / \text{P.V. Ratio}$$

#### **Graphic Method**

### **BREAK EVEN CHART:**

A Break Even Chart is a graphical presentation of marginal costing data. If the break - even chart point shown on the graph paper, it will assume the name of break even chart.

The break - even chart portrays a pictorial view of the relationships between costs, volume and profit. This chart shows the break - even point and also estimated profit or loss at various levels of output. The break - even point as indicated in the chart is the point at which the total cost line and total sales line intersect.

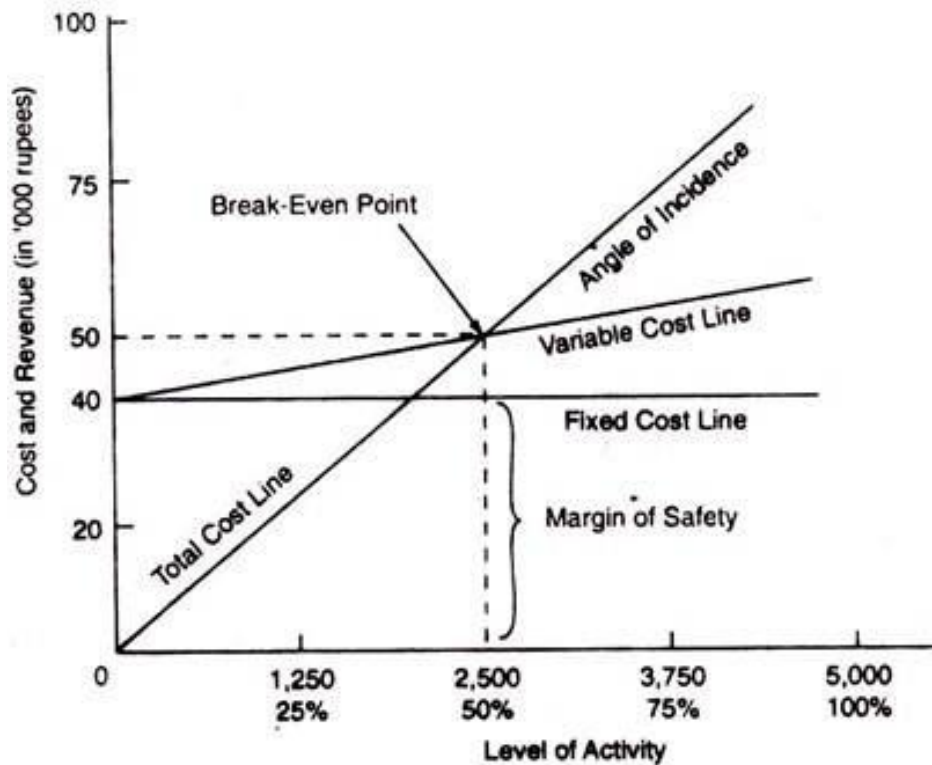


Fig. 8.2 : Break-Even Chart

### Significance of BEA:

Break - Even Analysis is a valuable tool to the management. BEA merits are;

- To ascertain the profit on a particular level of sales volume of a given capacity of production.
- To calculate the sales required to earn a particular desired level of profit.
- To compare the product lines, sales area, methods to sale for individual company.
- to compare the efficiency of the different firms.
- to decide whether to add a particular product to the existing product line or drop one from it.
- To decide to make / buy a given component or sparepart.
- To decide what promotion mix will yield optimum sales.

- h) To assess the impact of changes in fixed cost, variable cost or selling price on BEP and profits during a given period.

### **Limitations of BEA:**

BEA has certain limitations.

- a) BEP is based on fixed cost, variable cost and total revenue. A change in one variable is going to affect the BEP.
- b) All costs cannot be classified into fixed and variable cost. there is semi- variable cost also.
- c) In case of multi product firm, a single chart cannot be of any use. series of charts have to be make useful only in the short-run.
- d) Where the business conditions are volatile, BEP cannot give stable results.
- e) Total cost & total revenue lines arenot always straight as showninthe figure. the quantity and price/discounts are the usual phenomena affecting the total revenue line.

The Break- Even Analysis continues to be practical tool for the business community.

**Contribution** is the difference between sales and variable cost or marginal cost of sales. It may also be defined as the excess of selling price over variable cost per unit. Contribution is also known as Contribution Margin or Gross Margin. Contribution being the excess of sales over variable cost is the amount that is contributed towards fixed expenses and profit.

$$\begin{aligned}\text{Contribution} &= \text{Sales} - \text{Variable (Marginal) Cost} \\ &\text{or} \\ \text{Contribution (per unit)} &= \text{Selling Price} - \text{Variable (or marginal) cost per unit} \\ &\text{or} \\ \text{Contribution} &= \text{Fixed Costs} + \text{Profit (—Loss)}\end{aligned}$$

### **Advantages of Contribution:**

The concept of contribution is a valuable aid to management in making managerial decisions.

- 1. It helps the management in the fixation of selling prices.
- 2. It assists in determining the break-even point.
- 3. It helps management in the selection of a suitable product mix for profit maximization.



4. It helps in choosing from among alternative methods of production; the method which gives highest contribution per limiting factor is adopted.
5. It helps the management in deciding whether to purchase or manufacture a product or a component.
6. It helps in taking a decision as regards to adding a new product in the market.

## **P/V Ratio**

The Profit/volume ratio, which is also called the 'contribution ratio' or 'marginal ratio', expresses the relation of contribution to sales and can be expressed as under:

$$\text{P/V Ratio} = \text{Contribution/Sales}$$

The P/V ratio, which establishes the relationship between contribution and sales, is of vital importance for studying the profitability of operations of a business. It reveals the effect on profit of changes in the volume. If Higher the P/V ratio, more will be the profit and lower the P/V ratio, lesser will be the profit. Thus, every management aims at increasing the P/V ratio.

**The ratio can be increased by increasing the contribution. This can be done by:**

- I. Increasing the selling price per unit
- II. Reducing the variable or marginal cost.
- III. Changing the sales mixture and selling more profitable products for which the P/V ratio is higher.

The concept of P/V ratio is also useful to calculate the break-even point, the profit at a given volume of sales, the sales volume required to earn a given (or desired) profit and the volume of sales required to maintain the present profits if the selling price is reduced by a specified percentage.

## **Margin of Safety**

A **margin of safety** (MoS) is a difference between actual/budgeted sales and level of **breakeven** sales.

The margin of safety is a financial ratio that measures the amount of sales that exceed the [Break-Even Point](#). In other words, this is the revenue earned after the company or department pays all of its fixed and variable costs associated with producing the goods or services.

It's called the safety margin because it's kind of like a buffer. This is the amount of sales that the company or department can lose before it starts losing money. As long as there's a buffer, by definition the operations are profitable. If the safety margin falls to zero, the operations break even for the period and no profit is realized. If the margin becomes negative, the operations lose money.

Management uses this calculation to judge the risk of a department, operation, or product. The smaller the percentage or number of units, the riskier the operation is because there's less room between profitability and loss. For instance, a department with a small buffer could have a loss for the period if it experienced a slight decrease in sales. Meanwhile a department with a large buffer can absorb slight sales fluctuations without creating losses for the company.

### **Break Even Point Vs Margin of Safety**

	Break- Even point	Margin of safety
Meaning	1. It is the level of sales where a total of fixed and variable cost equals total revenues. No profit no loss situation	1. It is the difference between actual or budgeted sales and level of breakeven point
Usage	2. If it is lower better for the company	2. If it is higher better for company
Advantages	✓ Helps in understanding	✓ Helps in understanding

	<p>the relationship between fc, vc, profitability</p> <ul style="list-style-type: none"> <li>✓ Provides minimum level of sales to be achieved</li> <li>✓ Indicates impact on profitability due to change in selling price</li> <li>✓ Helps in decision making</li> </ul>	<p>the level of cushion that company has</p> <ul style="list-style-type: none"> <li>✓ Helps in making decisions about altering selling price to gain market share</li> <li>✓ Allows the company to spend on advertisement to increase the sales</li> </ul>
Dis - advantages	Fails to give results when the analysis being make is of multiple product scenario	The margin of safety, if turns out to be very high, may cause management to lead to inappropriate use of excess funds.

## Practice Problems

### Formulas used in Break - Even Analysis:

#### 1) Marginal Cost Equation:

$$\text{Sales} = \text{Variable cost} + \text{Fixed cost} + \text{Profit}$$

**or**

$$S = VC + FC + P$$

Sales – Variable cost = Fixed cost + Profit  
variable cost = sales - fixed cost - profit.

**2) Contribution** = Sales – Variable cost = Fixed cost + Profit

**3) Profit** = Contribution – Fixed cost

4) Profit Volume[P/V] Ratio = (C/S)X100.

5) Break Even Sales (in units) = Fixed cost / Contribution per unit.

Break Even Sales (in value) = Fixed Cost / P.V. ratio

6) Margin of safety [MOS] = Actual sales - break even sales

or

profit / PV ratio.

7) margin of safety ratio = (MOS/ Actual sales ) x 100.

8) when profit is given, to calculate sales

$$\text{sales} = \frac{\text{fixed cost} + \text{profit}}{\text{P. V. ratio}}$$

9) When sales are given, Profit to be calculate,

**sales (PV ratio) = fixed cost + profit.**

10) when two periods information is given,

$$\text{P.V. ratio} = \frac{\text{Difference or change in profit}}{\text{change in sales}} \times 100$$