

## Production function with one variable:

①<sup>3</sup>

### Introduction:

The law of variable proportions states that, "as more and more units of a variable factor are applied to the given quantity of a fixed factor, the total product may increase at an increasing rate initially, but eventually it will increase at a diminishing rate".

→ The production function with one variable input is also called law of returns (or) law of variable proportions (or) law of diminishing returns.

→ The law of variable proportion is a short-run production function where some factors are fixed and others are variable.

→ production function with one variable can be represented as,

$$Q = f(L, C, M)$$

where,

$Q$  = Quantity of the output produced.

$L$  = Labour units.

$C$  = Capital Employed.

$M$  = Materials.

→ It is assumed that in production function with one variable "capital and material" is a fixed factor and labour is variable input.

→ The firm

→ production function with one variable: Table Representation.

| Variable Input (L) | Total Product (TP) | Marginal Product (MP) | Average Product (AP) |
|--------------------|--------------------|-----------------------|----------------------|
| 0                  | 0                  | -                     | -                    |
| 1                  | 5                  | 5                     | 5.00                 |
| 2                  | 15                 | 10                    | 7.50                 |
| 3                  | 35                 | 20                    | 11.67                |
| 4                  | 45                 | 10                    | 11.25                |
| 5                  | 50                 | 5                     | 10.00                |
| 6                  | 50                 | 0                     | 8.33                 |
| 7                  | 45                 | -5                    | 6.43                 |

\*Explanation for table:

- The firm starts production with a fixed amount of capital and uses more and more units of labour.
- The product level increase at an increasing rate of labour initially, but eventually ~~at~~ <sup>product level</sup> started decreasing at increasing rate of Labour input.

\* Calculation for Total Product, Marginal Product (MP), Average Product (AP).

1) Total Product (TP): It is the amount of output that is produced by using different quantities of inputs.

$$TP = \sum MP_L$$

$$(81) \quad TP = AP \times N$$

where,

$MP_L$  = Sum of marginal product.

$TP$  = Total product.

$AP$  = Average product.

$N$  = Number of units of a factor.

### (2) Marginal product (MP):

It is defined as the change in the Total product (TP) per unit change in a variable input. Let the variable input labour ( $L$ ) be considered, the marginal product is,

$$MP_L = \frac{\Delta TP}{\Delta L}$$

where

$MP_L$  = Marginal product of Labour.

$\Delta TP$  = Change in total product.

$\Delta L$  = Unit change in the labour input.

### (3) Average product (AP):

It may be defined as the Total product (TP) per unit of variable input. If the variable input ' $L$ ' is considered, average product is,

$$AP_L = \frac{TP}{L}$$

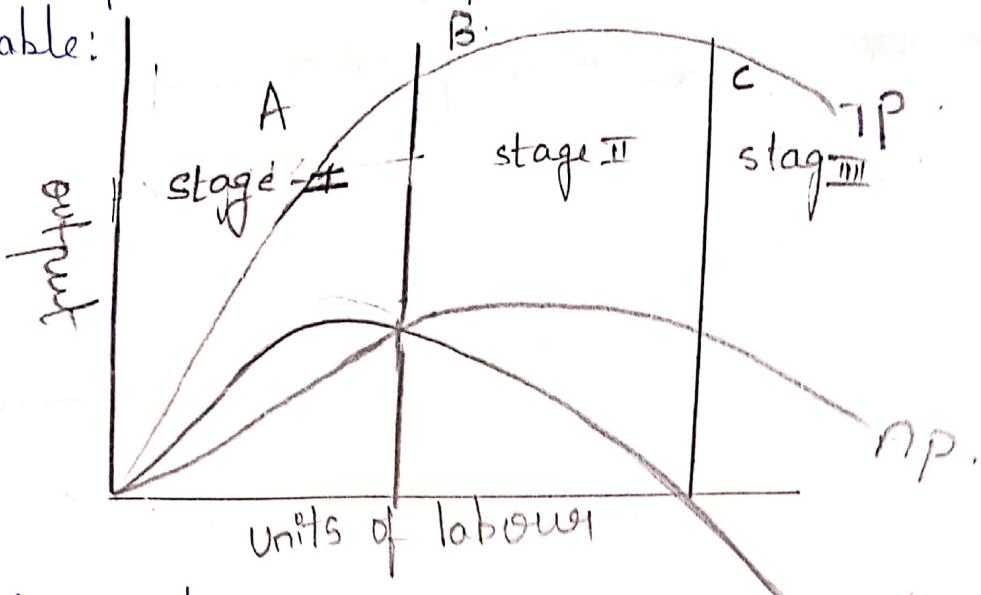
where,

$AP_L$  = Average product of Labour.

$TP$  = Total product.

$L$  = Labour units.

\* Graphical representation of production function with one variable:



\* Explanation for graph:

→ Stage 1 (Law of Increasing Return): In stage 1, the output increases at an increasing rate because of Labour to point A.

→ stage 2 (Law of Diminishing Return):

In this stage after point A, output increases at a declining rate till it reaches maximum point C.

→ stage 3 (Law of Negative Return):

In this stage after point c, the total output declines and the marginal product of labour is negative.

## \* Production Function with Two Variables: (3) 3

- The production function with two variable inputs is also known as production function Isoquants.
- The term Isoquants is derived from the words 'Iso' and 'quant'. where 'Iso' means Equal and 'quant' means quantity. So Isoquant means Equal quantity.
- In this type, the firm increase its output by using more of two inputs that are substitutes to each other. But in this type mostly same quantities of output that are produced by various combinations of inputs which are substituted each other.
- The production function with two variable is a long-run production function where all factors (or) inputs are variable.
- The production function with two variable can be expressed as:

$$Q = f(L, C)$$

where,

$Q$  = Quantity of output produced

$L$  = Labour units.

$C$  = Capital Employed.

\* Here  $L, C$  are Variable.

Example:

Consider a production function with the quantities of output produced by using different combination of two inputs Labour (L) and Capital (C).

Explanation with the help of arithmetical Table.

| Combinations | Labour(units) | Capital (units) | Output (quintals) |
|--------------|---------------|-----------------|-------------------|
| A            | 1             | 10              | 50                |
| B            | 2             | 7               | 50                |
| C            | 3             | 4               | 50                |
| D            | 4             | 3               | 50                |
| E            | 5             | 1               | 50                |

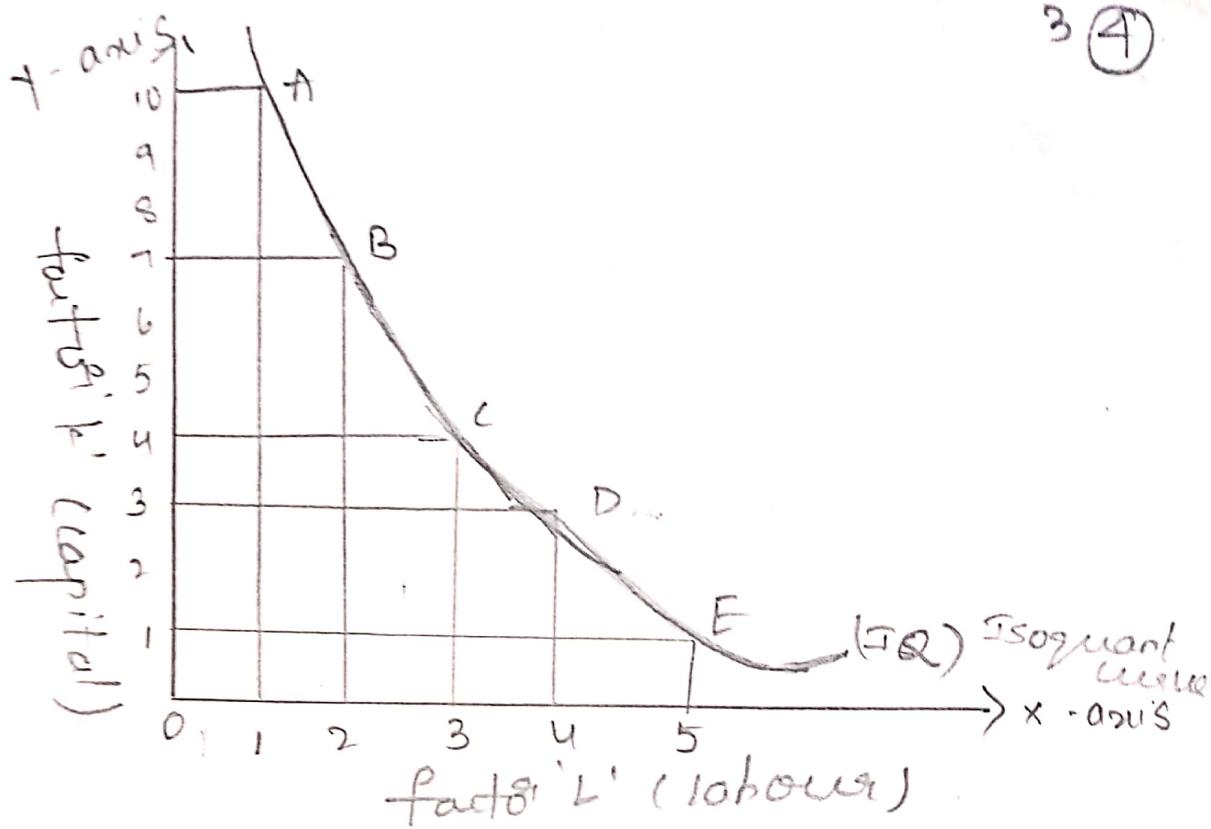
Explanation for Table:

- Combination 'A' represent 1 unit of labour and 10 units of capital and produces '50' quintals of a product.
- All other combinations in the table are assumed to yield the same given output of a product say '50' quintals by employing any one of the alternative combinations of the two factors labour and capital.

\* Graphical Representation:

If we plot all these Combinations on a paper and join them, we will get continuous and smooth curve called "Iso-product curve".

3 (4)

Explanation:

- Labour is on the  $x$ -axis and capital is on the  $y$ -axis.
- Isoquants curve be constructed conveniently for two inputs of production.

## Law of Returns to scale:

### Introduction:

The law of returns to scale refers to the relationship between inputs and the output in the long-run.

When all the inputs are varied in the same proportion and the output also varied.

### Definition:

"The term returns to scale refers to the changes in output as all factors change by the same proportion."

- [Koutsoyiannis]

"Returns to scale refer to the relationship between changes in output and proportionate changes in all factors of production."

- [Roger Miller]

### Types of Returns to scale:

#### Types of Returns to scale.

↓  
Law of increasing  
Returns to scale.

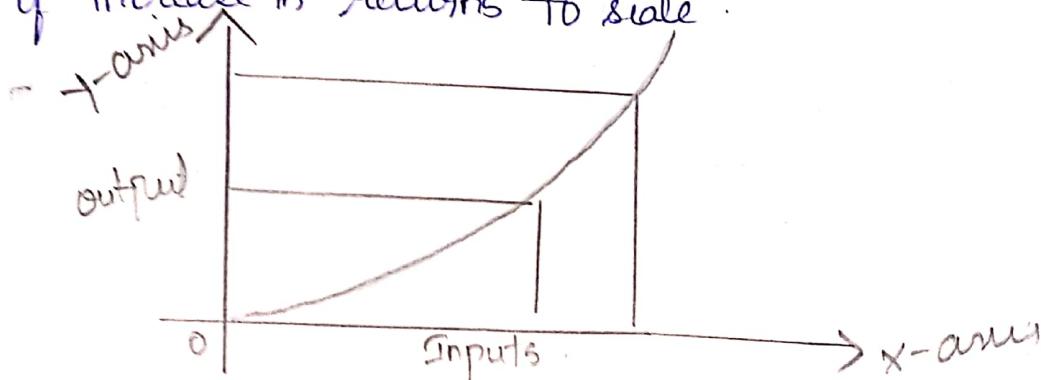
↓  
Law of Decreasing  
Returns to scale.

↓  
Law of Constant  
Returns to scale.

### 1) Law of Increasing Returns to Scale:

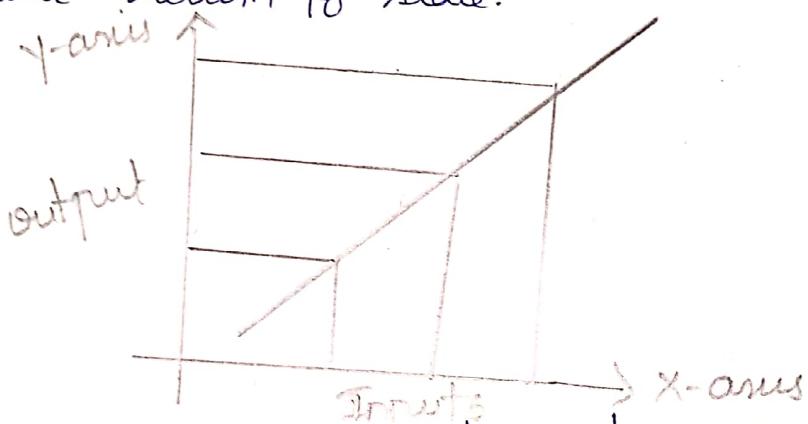
3 (5)

This law states that if output increases by more than an increase in input, then the situation is one of increase in returns to scale.



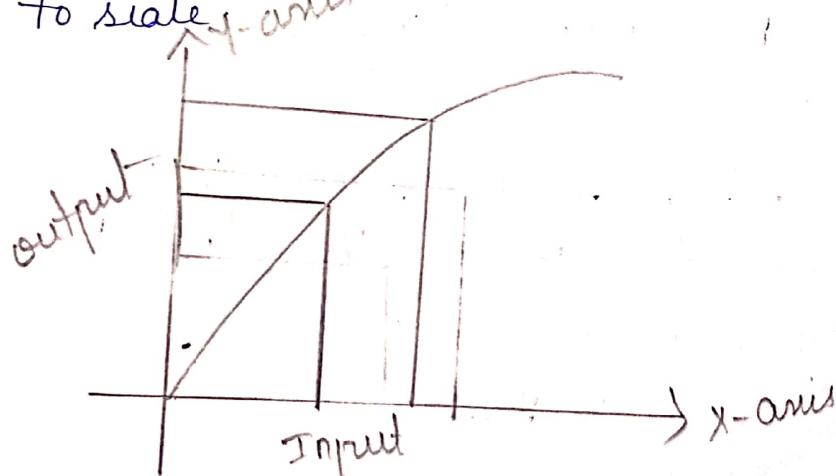
### 2) Law of Constant Returns to scale:

output may increase exactly the same proportion of input. This is considered as constant return to scale.



### 3) Law of Decreasing Returns to scale:

If output increase by less than the increase in input, then it is considered as decreasing returns to scale.



| Capital<br>(in units) | Labour<br>(in units) | percentage of<br>increase in both<br>inputs | output<br>(in units) | percentage of<br>Increase in<br>output | Laws<br>applicable.                   |
|-----------------------|----------------------|---|----------------------|--|---------------------------------------|
| 1                     | 3                    | 100 -                                       | -                    | -                                      |                                       |
| 2                     | 6                    | 100   | 120                  | 140                                    | Law of Increasing<br>Returns to scale |
| 4                     | 12                   | 100   | 240                  | 100                                    | Law of Constant<br>Returns to scale   |
| 8                     | 24                   | 100   | 360                  | 50                                     | Law of Decreasing<br>Returns to scale |

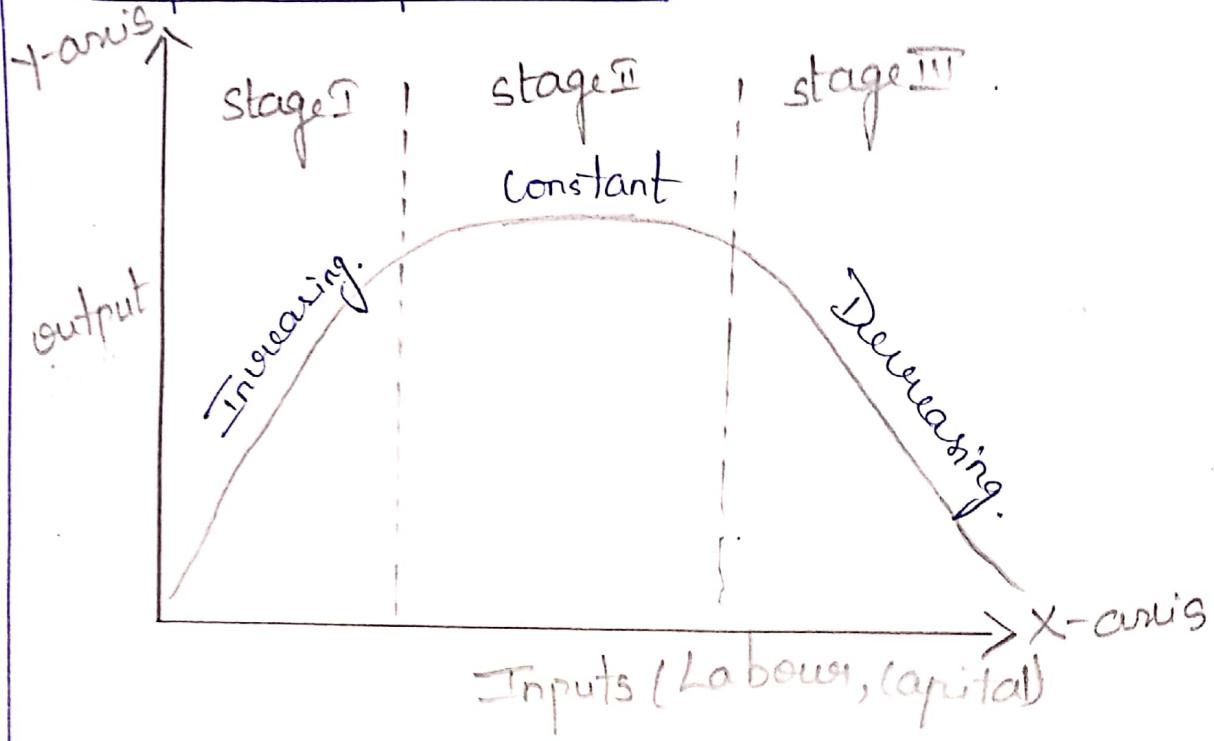
\* Explanation:

→ from the above table, it is clear that with 1 unit of capital and 3 units of labour, the firm produces 50 units of output. When the inputs are doubled two units of capital and six units of labour, the output has gone up to 120 units. Thus, when inputs are increased by 140%, that is, output has increased by more than double. This is governed by "Law of Increasing Returns to scale".

→ when the inputs are further doubled that is to 4 units of capital and 12 units of labour, the output has gone upto 240 units, (from 120 units to 240 units). Thus, when inputs are increased by 100 percent, the output also has doubled. This is governed by law of "Constant Returns to scale".

→ when the inputs are further doubled, that is, to 8 units of capital and 24 units of labour, the output has gone upto 360 units, (from 240 units to 360 units). Thus, when inputs are increased by 100%, it has increased only by 50%. This is governed by Law of Decreasing Returns to scale.

## \* Graphical Representation:



## Different Types of Production Functions :

Production function is the mathematical representation of relationship between physical inputs and physical outputs of an organization.

There are different types of production functions that can be classified according to the degree of substitution of one input by the other.

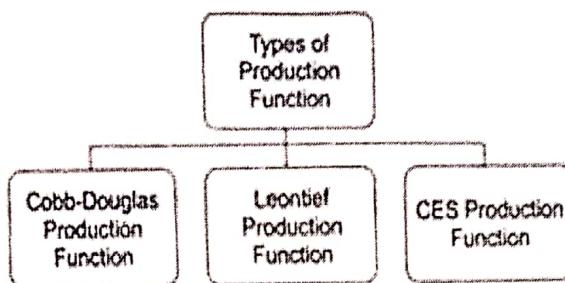


Figure-16: Types of Production Function

### 1. Cobb-Douglas Production Function:

Cobb-Douglas production function refers to the production function in which one input can be substituted by other but to a limited extent. For example, capital and labor can be used as a substitute of each other, but to a limited extent only.

**Cobb-Douglas production function can be expressed as follows:**

$$Q = AK^aL^b$$

Where, A = positive constant

a and b = positive fractions

$$b = \epsilon - a$$

**Therefore, Cobb- Douglas production function can also be expressed as follows:**

$$Q = ak^aL^{1-a}$$

### 2. Leontief Production Function:

Leontief production function uses fixed proportion of inputs having no substitutability between them. It is regarded as the limiting case for constant elasticity of substitution.

The production function can be expressed as follows:

$$q = \min(z_1/a, z_2/b)$$

Where, q = quantity of output produced

$Z_1$  = utilized quantity of input 1

$Z_2$  = utilized quantity of input 2

a and b = constants

For example, tyres and steering wheels are used for producing cars. In such case, the production function can be as follows:

$$Q = \min(z_1/a, z_2/b)$$

$Q = \min(\text{number of tyres used}, \text{number of steering used}).$

### **3. CES Production Function:**

CES stands for constant elasticity substitution. CES production function shows a constant change produced in the output due to change in input of production.

It can be represented as follows:

$$Q = A [aK^\beta + (1-a)L^\beta]^{-1/\beta}$$

Or,

$$Q = A [aL^\beta + (1-a)K^\beta]^{-1/\beta}$$

CES has the homogeneity degree of 1 that implies that output would be increased with the increase in inputs.

### **Production Function:**

#### **Definition:**

Samuelson define the production function as "the technical relationship which reveals the maximum amount of output capable of being produced by each and every set of inputs"

Michael define production function as "that function which defines the maximum amount of output that can be produced with a given set of inputs".

#### **Introduction:**

The production function expresses a functional relationship between physical inputs and physical outputs of a firm at any particular time period. The output is thus a function of inputs.

Mathematically production function can be written as:

$$Q = F(L_1, L_2, C, O, T)$$

Where  $Q$  = the quantity of production,

$F$  = the functions, that is, the type of relation between inputs and outputs

$L_1$  = land

$L_2$  = labour

$C$  = capital

$O$  = organization

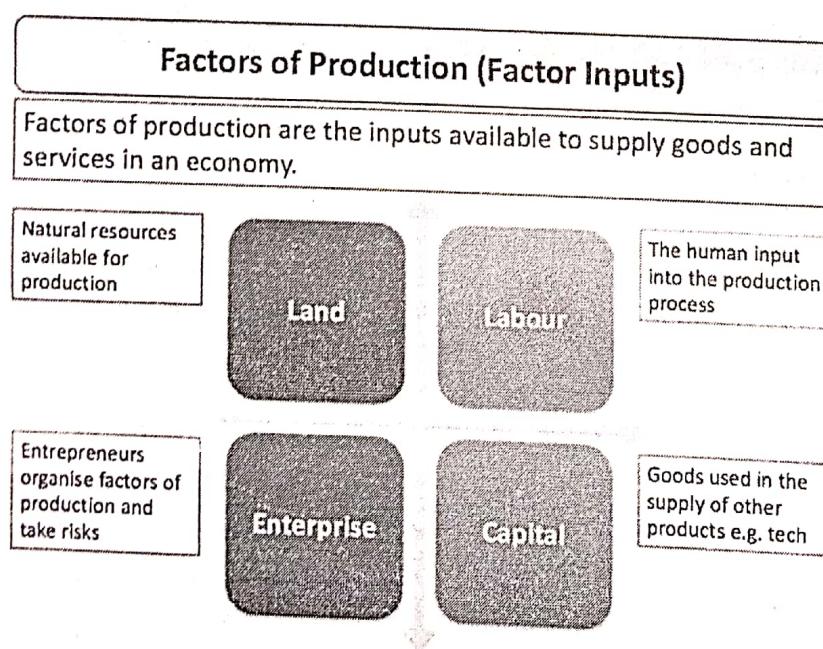
$T$  = technology

These inputs have been taken in conventional terms. In reality, material also can be included in a set of inputs.

A manufacturer has to make a choice of the production function by considering his technical knowledge, the process of various factors of production and his efficiency level to manage. He should not only select the factors of production but also should work out the different permutations and combinations which will mean lower cost of inputs for a given level of production.

In case of an agricultural product, increasing the other factors of production increase the production, but beyond a point, increase output can be had only with increased use of agricultural land, investment in land forms a significant portion of the total cost of production for output, whereas, in the case of the software industry, other factor such as technology, capital management and others become significant. With change in industry and the requirements the production function also needs to be modified to suit to the situation.

### Factors of Production:



**1. Land:** Land implies all types of natural resources used to create goods and services. In addition to land, it includes commodities such as gold, timber, oil, copper and water. Resources can also be renewable, such as forests, animals and food.

**2. Labour:** Human efforts done mentally or physically with the aim of earning income is known as labour. Thus, labour is a physical or mental effort of human being in the process of production. The compensation given to labourers in return for their productive work is called wages (or compensation of employees).

**3. Capital:** All man-made goods which are used for further production of wealth are included in capital. Thus, it is man-made material source of production. Alternatively, all man-made aids to production, which are not consumed/or their own sake, are termed as capital.

It is the produced means of production. Examples are—machines, tools, buildings, roads, bridges, raw material, trucks, factories, etc.

**4. Enterprise:** is the driving force behind the creation of a business. An entrepreneur finds ways to combine the other factors of production – land, labour and capital – to produce a product and make a profit. The most successful ones are the innovators who create new products to bring to consumers. Henry is an innovator who is bringing a new product to market

### Cost analysis:

→ for cost introduction Refer from page No:

**Introduction:** Cost is a resource sacrificed or forgone to achieve a specific objective. It is usually measured as the monetary amount (or money) that must be paid to acquire goods and services.

**Cost Analysis:** - It refers to the study of behaviour of cost in relation to one (or) more production criteria such as size of the output, scale of operations, prices of factors of production and other relevant economic variables.

**Types of Costs:** 1. **Fixed Costs (FC).** The costs which don't vary with changing output. Fixed costs might include the cost of building a factory, insurance and legal bills. Even if your output changes or you don't produce anything, your fixed costs stay the same.

2. **Variable Costs (VC).** Costs which depend on the output produced. For example, if you produce more cars, you have to use more raw materials such as metal. This is a variable cost.

**3. Semi-Variable Cost.** Labour might be a semi-variable cost. If you produce more cars, you need to employ more workers; this is a variable cost. However, even if you didn't produce any cars, you may still need some workers to look after empty factory.

Total Costs (TC) – Fixed + Variable Costs

$$TC = VC + FC$$

**4. Marginal Costs** – Marginal cost is the cost of producing an extra unit. If the total cost of 3 units is 1550, and the total cost of 4 units is 1900. The marginal cost of the 4th unit is 350.

**5. Opportunity Cost** – Opportunity cost is the next best alternative foregone. If you invest £1million in developing a cure for pancreatic cancer, the opportunity cost is that you can't use that money to invest in developing a cure for skin cancer.

**6. Economic Cost.** Economic cost includes both the actual direct costs (accounting costs) plus the opportunity cost. For example, if you take time off work to a training scheme. You may lose a weeks pay of £350, plus also have to pay the direct cost of £200. Thus the total economic cost = £550.

**7. Accounting Costs** – this is the monetary outlay for producing a certain good. *It relate to those costs only which involve cash payments by the entrepreneur of the firm*

**8. Sunk Costs.** These are costs that have been incurred and cannot be recouped. If you left the industry, you could not reclaim sunk costs. For example, if you spend money on advertising to enter an industry, you can never claim these costs back. If you buy a machine, you might be able to sell if you leave the industry. *Eq: depreciation*

**9. Avoidable Costs.** Costs that can be avoided. If you stop producing cars, you don't have to pay for extra raw materials and electricity. Sometimes known as an escapable cost.

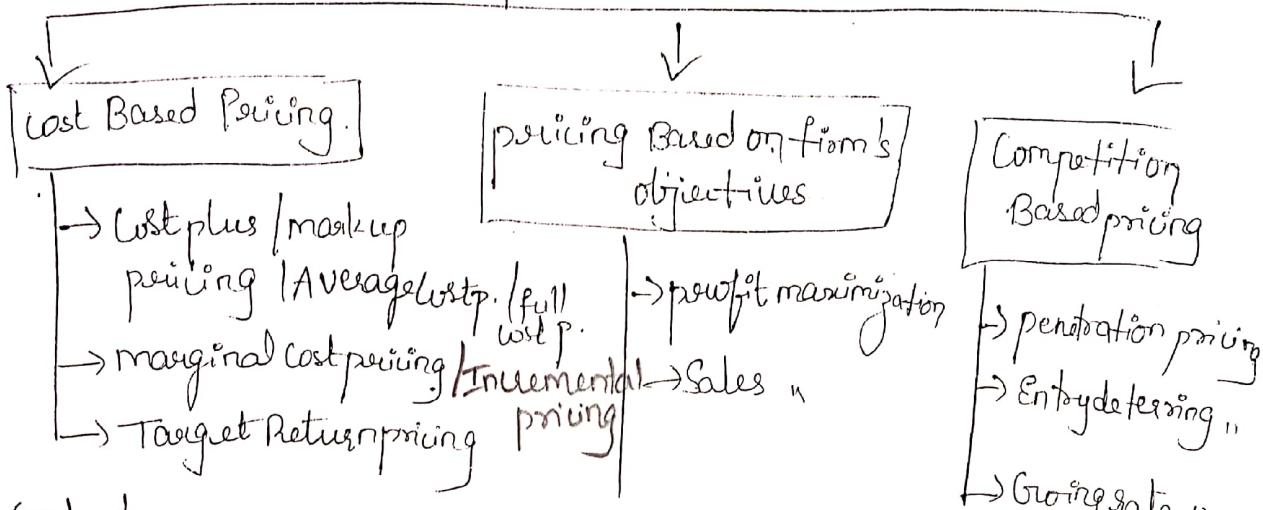
**10. Explicit Cost:** These costs are recorded in books of accounts. It is important for calculating profit and loss amounts. Eg: Rent payment, wages.

**11. Implicit Cost:** They are not recognized by the accounting system and are not recorded in the books of accounts. Eg: Depreciation on fully depreciated property still in use.

**12. Actual Cost:** The cost (of) expenditure which a firm incurs for producing (of) acquiring a good (or) service. Eg: Cost of Raw material, rent, interest, wage bill etc.,

⇒ price: denotes two aspects, on one hand it is revenue to the seller and on the other, it is the perceived value of the good (or) service to the buyer.

⇒ Types of Pricing:

Types

1) Cost plus pricing: under Cost plus pricing price of the product is the sum of cost plus a profit margin.

2) Marginal cost pricing: price of the product is the sum of variable cost plus a profit margin.

— competitive high.

3) Target Return pricing: a producer rationally decides the minimum rate of return that the product must earn.

— Company's experience, consumers' paying capacity, Risk involved.

4) Profit maximization: A firm which aims to earn maximum profit would naturally consider total cost of production for determination of price of

hence will adopt markup pricing.

5) Sales maximization: maximise sales instead of profit maximization, such that such firms would have to adopt wrong-competitive pricing - margin cost.

6) Penetration pricing: when a firm plans to enter a new market which is dominated by existing players its only option is to charge a low price, even lower than the ongoing price. This price is called penetration pricing.

7) Entry Detering pricing:- Monopoly depends upon

entry barriers

- unattractive for other players

\* Under entry deterring pricing the price is kept low, thus making the market unattractive for other players. It is also known as limit pricing.

8) Going Rate pricing: Not under going rate pricing most of the players do not indulge in separate pricing but prefer to follow the prevailing market price. — Seeing the price setting in industry

- Dominant firm going to fix the price on industry

- This strategy popular in monopolistic & oligopoly markets.

[you can include product life cycle based pricing types]

They are: 1) price skimming

2) product Bundling (or) packaging

3) perceived value pricing

4) value pricing

5) Loss Leader pricing.

## Cost Profit Volume Analysis: rev 3

Introduction: cost cvp analysis is a managerial accounting technique that is concerned with the effect of sales volume and product costs on operating profit of a business. It deals with how operating profit is affected by changes in variable costs, fixed costs, selling price per unit & the sales mix of two (or) more different products.

### Assumptions:

- Sales price per unit is constant
- VC constant
- FC constant
- Everything produced is sold.
- If a company sells more than one product, they are sold in the same mix.

### CVP analysis formula:

$$Px = Vx + Fc + profit$$

~~x are total no. of units produced & sold.~~

~~p is price per unit.~~

$$\downarrow = VC$$

$$Fc = Fc$$

Key calculations when using CVP analysis are the contribution margin,

- It is equal to the difference b/w total sales and total variable cost.

$$\rightarrow \boxed{CM = S - VC}$$

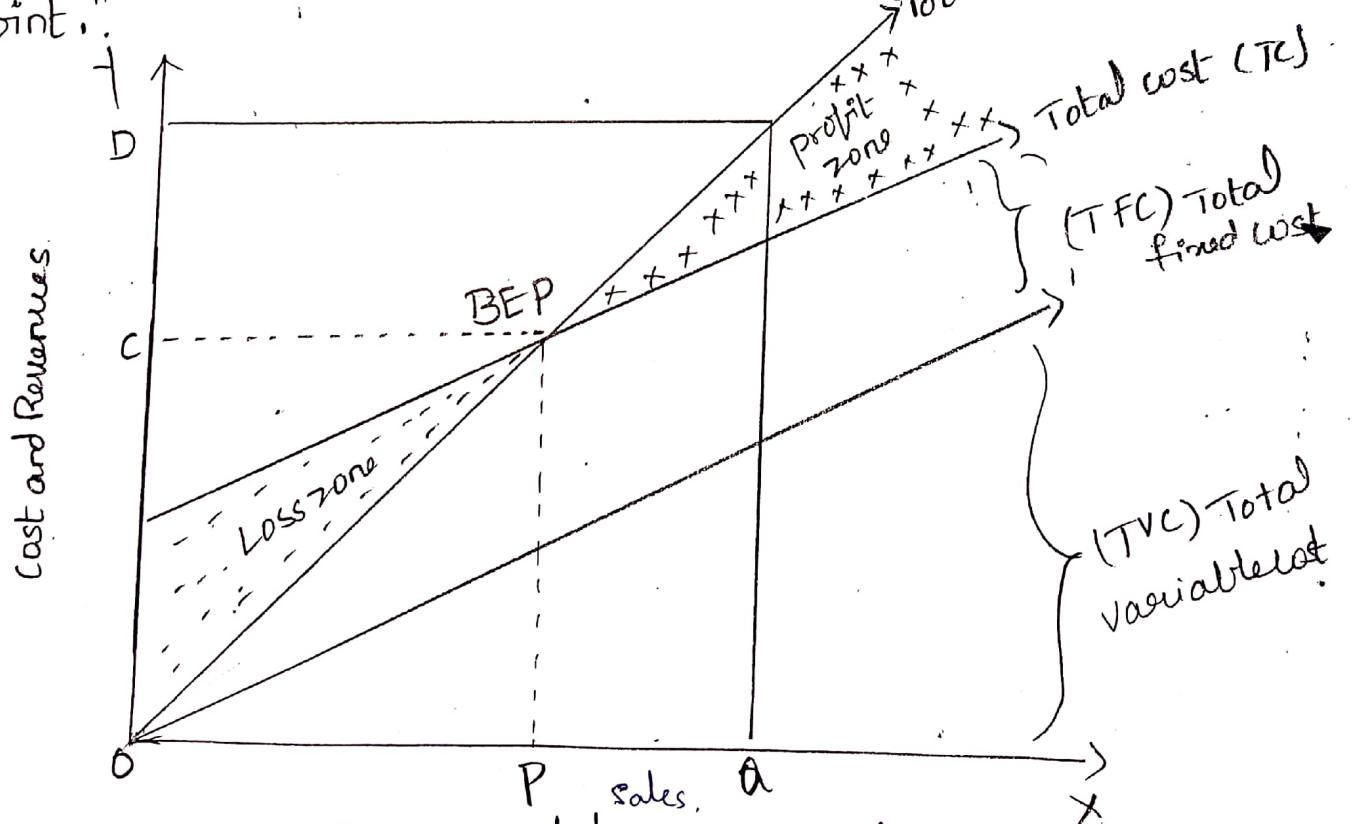
## Break Even Analysis

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→ Introduction: It Examines the Relationship between total Revenue, Total cost (TC) & Total profits of a firm at different levels of output.

- It is about determining profit at various projected levels of sales, identifying the (BEP) "Break Even point" and making a managerial decision regarding the relationship between likely sales and the BEP.
- Finding Break Even point (BEP) is the first step in any planning decision.

→ "Break Even Point": is the point where total cost just equals the total Revenue, it is the "no profit no loss point".



Graphical Representation of Break Even point.

## $\Rightarrow$ Assumptions of Break Even Analysis:

1. Break - even analysis assumes that the total cost is divided into two categories i.e. (i) fixed cost and (ii) variable cost.  
It totally ignores the semi-variable costs.
2. Fixed cost remains constant throughout the volume of production
3. The selling price of the product is constant throughout the sale.
4. The variable cost changes proportionally (at constant rate) with volume of production.
5. All the goods produced are sold i.e. volume of production and sales are equal (i) there is no closing stock.
6. The firm is producing only one type of product. In case of multi-product firm, the product mix is stable.

## $\Rightarrow$ Advantages / Importance / significance / Applications of Break Even Analysis:-

1. BEA is useful in determining optimum level of output, below which it is not profitable for the firm to produce its products.
2. To determine minimum cost for a given level of output.
3. To determine impact of changes in cost (i) selling price on BEP.
4. Managerial decision on adding (i) dropping product is done by BEA.
5. It also helps in choosing a product mix when there is a limiting factor.
6. BEA shows likely profits and losses at various levels of production.

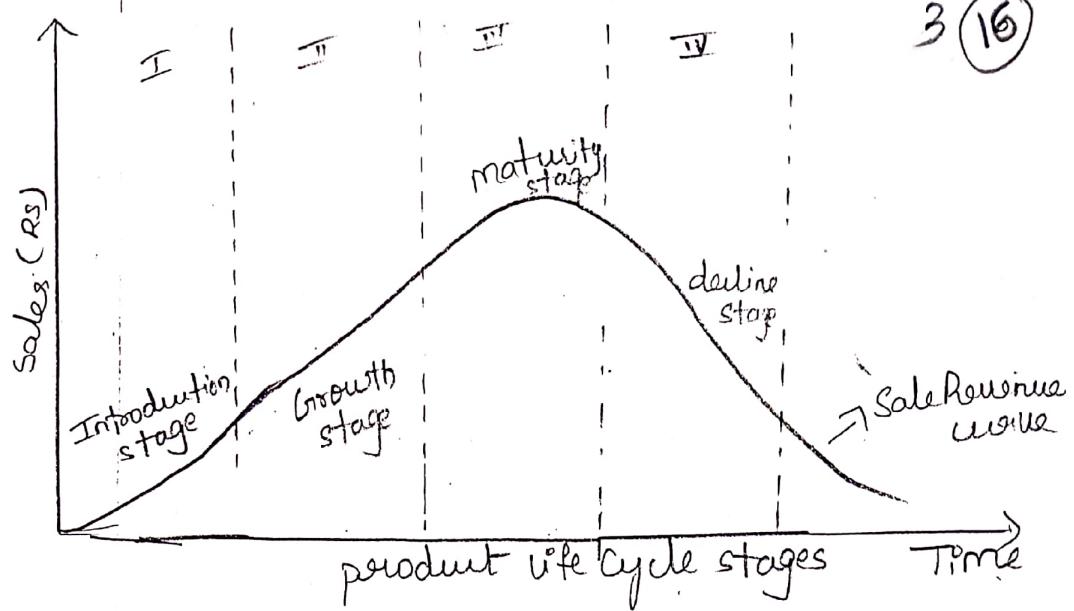
7. It is useful in budgeting and profit planning. 3 (15)
8. Break - even chart portrays margin of safety.
9. It is a decision making tool in the hands of management.
- ⇒ Limitations (or) disadvantages of Break Even Analysis :
1. The analysis is based on fixed costs, variable costs and total revenue. Any change in one variable affects Break - Even point.
  2. Semivariable costs and depreciation are not accounted which is significant in any manufacturing firm.
  3. Multiple charts are to be produced in case of multi-product firm.
  4. The effect of technological development, managerial effectiveness also determines profitability.
  5. The Break - even chart is based on fixed cost concept and here holds goods for a short period.
  6. Break - even analysis is not suitable under fluctuating business environment.

## Product Life Cycle Based Pricing

⇒ Introduction to Pricing: It denotes two aspects, on one hand it is revenue to the seller and on the other it is the perceived value of the good (or) service to the buyer.

⇒ Introduction to product life cycle based Pricing:

- product life cycle based pricing refers to different pricing for a product at different stages of its life cycle.
- Every product passes through many stages starting from introduction, going through growth and maturity and leading to saturation and ultimately reaches decline.
- Each phase is unique in itself, with varied features. Moreover a product faces different demand patterns and competition levels under different stages; hence there is a need for revising its price as it passes through different stages.
- charging a uniform price for a product across all these stages would amount to less than optimum revenue for the firm.
- Instead an "intelligent" firm would devise different pricing for a product at different stages of its lifecycle.  
Eg: first television with flat screen introduced in the market with high price after some period the price is decline for attracting customers.



⇒ The most popular strategies under this category are:

- 1) price skimming.
- 2) product Bundling (or) packaging
- 3) perceived value pricing
- 4) value pricing
- 5) Loss leader pricing.

1) price skimming: Under price skimming producers charge a very high price in the beginning to slim the market and earn super margins on sales.

Eg: Ticket of a movie on the very first day of its release  
price of ticket will be high also viewers will prefer to buy ticket.

2) Product Bundling (or) Packaging:- Under product bundling two (or) more products are bundled together for a single price.  
 → This strategy is often used as a double edged weapon for propagating a new product, as well as for selling a product in its stage of decline.

Eg: A tourist agency would charge only airfare for a holiday destination which would include hotel stay, sight seeing etc,

3) Perceived value pricing: According to perceived value pricing, value of goods for different consumers depends upon their perception of utility of the good.

- Therefore the price a consumer is willing to pay would reflect the value of that product to him/her.

Eg: Titan watches, Tanishq jewellry are some of the brands which have consistently resorted to perceived value pricing by creating hype about high quality.

- 4) Value pricing: Under value pricing sellers try to create a high value of the product and charge a low price.
- This is a strategy suitable for the maturity and saturation stage when demand can be maintained by keeping focus on higher quality and lower cost.

Eg: Krutons brand of men's

- 5) Loss leader pricing: Under loss leader pricing multi-product firms sell one product at a low price and compensate the loss by other products.

- The success of this strategy largely depends upon a combination of goods which are complementary in nature and one product cannot be utilized without the other product.

Eg: pen and ink, printer and cartridge.

## Terminologies used in Break Even Analysis

3 (1)

1) fixed cost: It remain fixed in the short run.

Eg: Rent, insurance fee ( $\text{Sales} \times \text{P/V ratio}) - \text{Profits}$

2) variable cost: It vary with the volume of production.

Eg: direct labour, direct expenses

3) Total Cost: ( $T_C$ )

$$T_C = \text{fixed cost} + \text{variable cost}$$

4) Total Revenue: ( $TR$ )

$$TR = \text{Selling price per unit} \times \text{No. of units sold}$$

5) Profit:

$$\text{Profit} = \text{Total Revenue} - \text{Total Cost}$$

6) Contribution Margin:

$$= \text{Selling price per unit} - \text{Variable cost per unit}$$

(3)

$$= \text{fixed cost} + \text{profit per unit}$$

7) Contribution margin Ratio:

$$= \frac{\text{Selling price} - \text{Variable cost}}{\text{Selling price}}$$

8) Margin of safety in units:

$$= \frac{\text{Excess of actual sales} - \text{The Bep}}{\text{(units)}} \quad \text{(units)}$$

9) Margin of safety in sales volume:

$$= \frac{\text{Excess of actual sales} - \text{The Bep}}{\text{(in Rupees)}}$$

(3) Net profit P/V ratio.  $(\text{in Rupees})$

10) Angle of incidence: The angle formed when total cost curve cuts the total revenue curve.

11) P/V ratio: (Profit - Volume)

(a) P/V ratio =  $\frac{\text{Contribution}}{\text{Sales}} \times 100$ .

(g)

$$= \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100.$$

(g)

$$= \frac{\text{Change in Contribution}}{\text{Change in Sales}} \times 100.$$

(g)

$$= \frac{\text{Selling price} - \text{Variable cost}}{\text{Selling price}} \times 100.$$

## (12) Break Even Point :

3 (12)

### (a) Determination of BEP in units :

$$\text{BEP (units)} = \frac{\text{Fixed costs}}{\text{(Selling price per unit} - \text{Variable cost per unit})}$$

=  $\frac{\text{Contribution Margin per unit}}{\text{Total fixed cost}}$

### (b) Determination of BEP in Value :

$$\text{BEP (Rupees/Value)} = \frac{\text{fixed cost}}{\text{Contribution Margin Ratio}}$$

$$(i) \text{ BEP} = \frac{\text{fixed costs}}{\text{P/V ratio.}}$$

\* P/V means profit volume ration

$$= \frac{\text{Total fixed cost}}{\text{Total revenue} - \text{Total variable cost.}}$$

$\times \frac{\text{Selling price}}{\text{Selling price per unit} - \text{Variable cost per unit}}$

$$= \frac{\text{Total fixed cost}}{\text{Selling price per unit} - \text{Variable cost per unit}}$$

## Problems:

① A firm has a fixed cost of Rs 10,000; selling price per unit is Rs. 5 and variable cost per unit is Rs 3.

(i) Determine BEP in terms of volume and also sales value.

(ii) Calculate the margin of safety considering that the actual production is 8000 units.

[Ans: (i) BEP (units) = 5000 ; BEP (Value) = 25000 Rs/-  
units.]

(ii) Margin of safety = 3000 units]

② A high tech rail can carry a maximum of 36,000 passengers per annum at a fare of Rs. 400. The variable cost per passenger is Rs. 150 while the fixed costs are 25,00,000 per year. Find the Break Even point in terms of number of passengers and also in terms of fare collections. [Ans: BEP (units) = 10000 passengers  
BEP (in Rupees) = Rs. 40,00,000/-]

③ Sales of ₹ 1,10,000 producing a profit of ₹ 4000 in period-I. Sales of ₹ 1,50,000 producing a profit of ₹ 12,000 in period-II. Determine BEP and fixed expenses. [Ans: P/V ratio = 20%] [fc = Rs. 18,000] BEP = 90000

④ Sale of a product amounts to 20 units per month and fixed overheads are ₹ 400 per month ₹ 10 per unit. Fixed overheads are ₹ 400 per month and variable cost is ₹ 6 per unit. There is a proposal to reduce prices by 10%. Calculate present and future P/V ratio.

[Ans: Present P/V ratio = 40% ; Future P/V ratio = 33.33%]

(3) If the following cost data is available for 1966  
Excess in pounds:

|               | Year I (Rs) | Year II (Rs) |
|---------------|-------------|--------------|
| Sales         | 50000       | 120000       |
| Fixed Costs   | 10000       | 20000        |
| Variable Cost | 30000       | 60000        |

→ Determine (a) BEP (b) Margin of safety.

$$\textcircled{1} \text{ (a) } \underline{\text{BEP in units}} = \frac{\text{fixed cost}}{\text{contribution margin per unit}} \\ \rightarrow \text{contribution margin per unit} = \text{selling price per unit} - V_p \\ = 5 - 3 \\ = 2.$$

$$\text{BEP} = \frac{10000}{2} = 5000 \text{ units.}$$

$$\text{(b) } \underline{\text{BEP in Rupees}} = \frac{\text{fixed cost}}{\text{contribution margin Ratio}}.$$

$$\rightarrow \text{contribution margin ratio} = \frac{\text{selling price} - \text{variable cost}}{\text{selling price}} \\ = \frac{10000}{5} = 25000 \text{ RS.}$$

(c) determination of Margin of safety.

$$\rightarrow \text{margin of safety (units)} = \text{no. of units sold} - \text{BEP} \\ = 8000 - 5000 \\ = 3000 \text{ units.}$$

\textcircled{2} Same like above ~~for problem & formulas also~~  
Same.

| period | sales    | profit |
|--------|----------|--------|
| I      | 1,10,000 | 1000   |
| II     | 150000   | 12000  |

$$\text{(a) P/V ratio} = \frac{\text{change in profit}}{\text{change in sales}} \times 100 \\ \text{change in sales.}$$

$$= \frac{12000 - 4000}{150000 - 110000} \times 100 \\ = 20\%.$$

$$(b) \text{ -find last: } -( \text{sales} \times \text{margin}) = \text{profits}^3$$

$$= (110000 \times 0.20) - 4000$$

$$= \text{Rs } 18,000$$

u Sales = 20 units

$$SP = RS \cdot 10 \text{ Pa unit}$$

$$F_c = \frac{1}{2} 400 .$$

$$V_C = \frac{1}{2} 6 \text{ per unit}$$

→ present plv ratio:

$$= \frac{Sp - Vc}{Sp} \times 100$$

$$= \frac{10 - 6}{10} \times 100 = 40\%$$

→ future pluraction

$$= \frac{SP - VC}{SP} \times 100$$

$$= \frac{9-6}{9} \times 100$$

$$= 33 \cdot 33 \cdot 1.$$

|       | X             | X             |
|-------|---------------|---------------|
| (5)   |               |               |
| Sales | 50 000        | 120 000       |
| (-)   | variable cost | <u>30 000</u> |
|       |               | <u>60 000</u> |
| (-)   | Contribution  | 20 000        |
|       |               | <u>60 000</u> |
| (-)   | fixed cost    | <u>10 000</u> |
|       |               | <u>90 000</u> |
|       | Net profit    | <u>10 000</u> |
|       |               | <u>10 000</u> |

→ P/V ratio:

Year I (Rs)

Year II (Rs)

$$= \frac{\text{Contribution}}{\text{Sales}} \times 100$$

$$= \frac{20000}{50000} \times 100$$

$$= 40\%$$

$$= \frac{60000}{120000} \times 100$$

$$= 50\%$$

→ BEP:

$$= \frac{\text{Fixed Cost}}{\text{P/V ratio}}$$

$$= \frac{10000}{40\%}$$

$$= ₹ 25000/-$$

$$= \frac{20000}{50\%}$$

$$= ₹ 40000$$

→ margin of safety:

$$= \frac{\text{Net profit}}{\text{P/V ratio}}$$

$$= \frac{10000}{40\%}$$

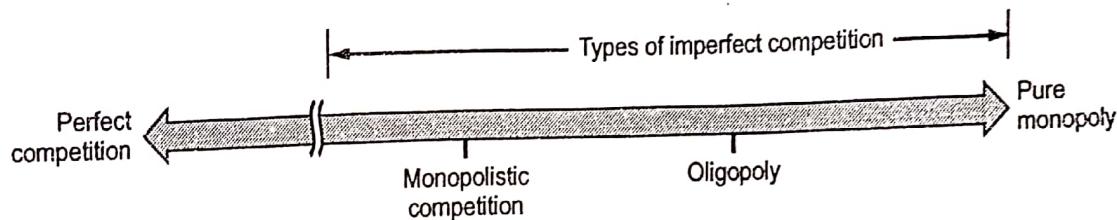
$$= ₹ 25,00,000$$

$$= \frac{40000}{50\%}$$

$$= ₹ 80,00,000$$

### 3.3 Market Competition

- The behaviour of firms in different circumstance can be determined by amount of competitions it faces. To understand clearly just what effect competition has, different market conditions are to studied. On the basis of nature of competition there exists different types of market forms. These are
  - Perfect or pure competition
  - Imperfect competition
  - Pure or absolute monopoly.
- Fig. 3.3.1 shows different types of competition. A gap is shown between perfect competition and imperfect competition since perfect competition is only a theoretical possibility.



**Fig. 3.3.1 Types of competition**

- At one extreme is **perfect competition**, where there are many firms competing. Each firm is so small relative to the whole industry that it has no power to influence price. It is a price taker. At the other extreme is **monopoly**, where there is just one firm in the industry, and hence no competition, from within the industry. In the middle comes **monopolistic competition**, where there are quite a lot of firms competing and where there is freedom for new firms to enter the industry, and **oligopoly**, where there are only a few firms and where entry of new firms is restricted.
- The market structure under which a firm operates will determine its behavior. Firms under perfect competition will behave quite differently from firms that are monopolists, which will behave differently again from firms under oligopoly or monopolistic competition.
- This behaviour will in turn affect the firm's performance it's prices, profits, efficiency etc. In many cases it will also affect other firm's performance, their prices, profits, efficiency etc. The collective conduct of all the firms in the industry will affect the whole industry's performance.
- Economists thus see a causal chain running from market structure to the performance of that industry. Structure → Conduct → Performance.

### **3.3.1 Perfect Competition**

- In perfect competition, all firms are separate and independent from each other. Each firm operates as an individual enterprise looking only to its own best interests. Perfect competition is an extreme situation in which competition is as strong as it could ever possibly be.
- The theory of perfect competition illustrates an extreme form of capitalism. In it firms are entirely subject to market forces. They have no power whatsoever to affect the price of the product. The price they face is that determined by the interaction of demand and supply in the whole market.
- There is complete freedom of entry of new firms into the industry. Existing firms are unable to stop new firms setting up in business. Setting up a business takes time, however. Freedom of entry therefore applies in the long run. An extension of this assumption is that there is complete factor mobility in the long run. If profits are higher than elsewhere, capital will be freely attracted into the industry.

**Definition of perfect competition :**

- A market structure in which there are many firms, where there is freedom of entry to the industry, where all firms produce an identical product and where all firms are price takers.

### **3.3.1.1 Features of Perfect Competition**

**i) Large number of buyers and sellers :**

- There must be so many participants (buyers and sellers) involved that no one of them acting alone is able to have any noticeable effect on the overall demand or supply position.
- Every firm is too small to affect the market. That means no matter how much it produces, it can sell its entire production at the going market price. The output of any firm is only a small portion of the total demand in the market. Moreover, it will not raise its price above the market price, because they can't sell much because consumers would rather buy from its lower priced competitions.

**ii) A homogeneous product :**

- The goods from each of the sellers must be absolutely identical (standardized) in every respect to those of all the others. This means there is no advantage for the consumer to buy from any particular supplier rather than any other. This ensures price uniformity for the same product in market. No individual firm is able to influence the market price.

**iii) Perfect knowledge :**

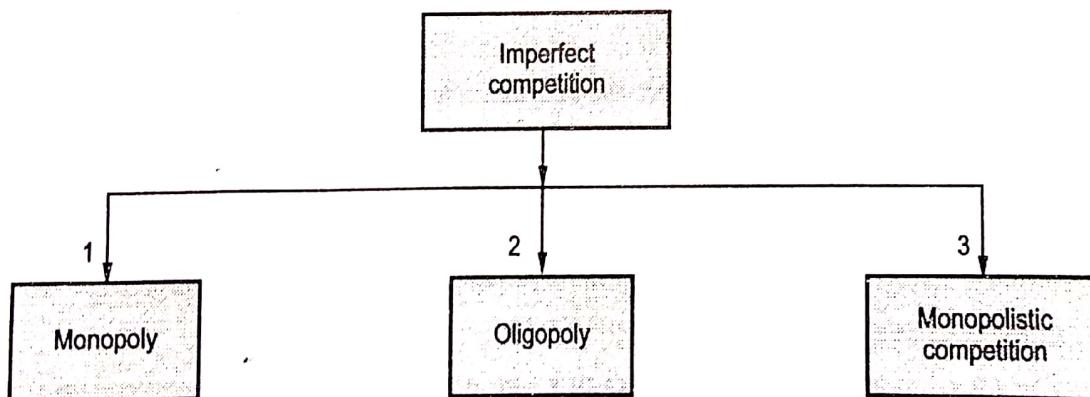
- There are two aspects of perfect knowledge :
  - A) Sellers and buyers must know the prices being asked in other parts of market.
  - B) In order to make free entry to new seller, a would be producer must also know what profits are being made by the existing producers.
- No one has any privileged information. All participants are fully informed, all the time, about everything.

**iv) Freedom of entry and exit :**

- Everyone involved is a willing participant, all the firms in market earns normal profit. Any seller can enter any time and exit any time also there is no restriction on entry or exit.

**3.3.2 Imperfect Competition**

- If a firm can appreciably affect the market price of its output then the firm is classified as an imperfect competitor.
- Imperfect competition exists whenever individual sellers have some measure of control over the price of their output.
- Modern industrial economy have different varieties of imperfect competition depending on the numbers and sizes of sellers, and how much of the market the large sellers control. Economists classify imperfectly competitive markets into three different market structures. Fig. 3.3.2 shows the market structure of imperfect competition.

**Fig. 3.3.2 Imperfect market structure****3.3.2.1 Monopoly**

- Monopoly is exactly at the opposite end of the perfect competition. This sort of market is used to illustrate a situation in which there is no competition at all i.e. a single seller with complete control over the industry. It is the only one

producing in the industry and no industry is producing its close substitute. But true monopolies are rarely existing today. They can exist typically with some form of government protection e.g. Indian Railways, Post and Telegraph services (P&T).

The market form of perfect monopoly is highly abstract.

- A monopolist has no competitors. This is the great advantage of being monopolist. It can earn super normal profits.
- Another example of monopoly is a franchised local authority such as local telephone, cable TV, gas and electricity. Here there is single seller of a service with no close substitute. But in today's most highly competitive market even government protected monopolists face competition. e.g. cellular telephones competes with traditional land line phones, private gas agencies compete with government LPG companies (BP and IP).
- Thus in the long term, no monopolist is completely secured from attack of competitors.

#### Features of monopoly :

1. There is only one seller or producer.
2. There is no free entry to the new seller in the market.
3. There is no close substitute for the product or services provided by the monopolist.
4. Monopolist decides the pricing and service conditions.
5. Monopolist enjoys the supernormal profits.
6. Method of marketing - The monopolist's need to brand his product and advertise depend on the threat of competition rather than an actual competition.

#### **3.3.2.2 Oligopoly**

- Oligopoly means a few. An oligopoly is a market with only a few sellers. Few, in this context, can be 2 number as small as 2 or as large as 10 or 12 firms. It is a very common situation.

For example, department stores, grocery stores, newspaper agents, electrical retailers, supermarkets, banks, petrol pump, shoe shops in your area.

- Oligopoly is an important market form. In our country oligopoly market situation exists almost in every town. There are only a few suppliers operating in the market, so each provides a major part of the total market supply. It is important to recognize, whether the actions of individual firms can affect the market price. The decision of single firm can change the market condition. The other firms have to respond to the changed conditions.

For example, in airlines industry, the decision of a single airline to lower fares can set off a price war which brings down the fares charged by all its competitors.

- Other than price competitions between the firms, the firms compete on following things such as - quality, design, service, after sales support, packaging, luxury, styling, marketing, advertising etc.
- The result is oligopolistic firms often have very aggressive selling policies rather than conservative pricing policy. Therefore consumers often gets benefit of choice of suppliers, quality and services and price benefit as well.

#### Features of oligopoly :

1. Few producers in the market.
2. Product features may be same (homogeneous) or may not same (differentiated).
3. Each seller has to take into account the reaction of rival to his own pricing policy.
4. Limited entry for the sellers in the market.
5. Consumers get the benefit of competition.
6. Method of marketing - Advertising, rivals quality and price.

#### Key features of oligopoly

##### 1. Barriers to entry :

- Unlike firms under monopolistic, there are various barriers to the entry of few firms. These are similar to those under monopoly. The size of the barriers, however, will vary from industry to industry. In some cases entry is relatively easy, whereas in others it is virtually impossible.

##### 2. Interdependence of the firms :

- Because there are only a few firms under oligopoly, each firm will have to take account of the others. This means that they are mutually dependent, they are interdependent. Each firm is affected by its rival's actions. If a firm changes the price or specification of its product, for example, or the amount of its advertising, the sales of its rivals will be affected. The rivals may then respond by changing their price, specification or advertising. No firm can therefore afford to ignore the actions and reactions of other firms in the industry.

### 3.3.3 Monopolistic Competition

- Monopolistic market structure refers to a market where there are many sellers but each has unique product to sell. They are all monopolists for the supply of their own product particular.

- But they are all in competition with other suppliers of very similar sorts of products.  
e.g. The car industry is a good example. Each car maker sells a unique vehicle. No one car maker can offer exactly the same type of car. All cars are to some extent substitutes for each other. So each car maker is engaged in a competitive battle with all the other car makers.
- Monopolistic competition is similar to oligopoly. The distinction is that, in monopolistic competition there are many producers as compared to few in oligopoly. And the product differentiation is also more in monopolistic competition. It is the product differentiation which makes monopolistic competition different from the perfect competition and which causes its own consequences for the product and performance of the sellers.

#### Assumptions of monopolistic competition :

1. There is quite a large number of firms : As a result, each firm has an insignificantly small share of the market and therefore, its actions are unlikely to affect its rivals to any great extent. What this means is that each firm in making its decisions does not have to worry about how its rivals will react. It assumes that what its rivals choose to do will not be influenced by what it does. This is known as the assumption of independence.
2. There is freedom of entry of new firms into the industry. If any firm wants to setup in business in this market, it is free to do so. In these two respects, therefore, monopolistic competition is like perfect competition.
3. Unlike perfect competition, however, each firm produces a product or provides a service that is in some way different from its rivals. As a result, it can raise its price without loosing all its customers. Thus its demand curve is downward sloping, also relatively elastic given the large number of competitors to whom customers can turn. This is known as the assumption of product differentiation.
- Petrol stations, chemist shops, hair dressers and builders are all examples of monopolistic competition.
- A typical feature of monopolistic competition is that, although there are many firms in the industry, there is only one firm in particular location. This applies particularly in retailing. There may be many green grocers in a town, but only one in a particular street. In a sense, therefore, it has a local monopoly. People may be prepared to pay higher prices therefore their vegetables to avoid having to go elsewhere.

#### Features of monopolistic competition :

1. Competition amongst the many producers.
2. Free entry to new producer.

3. The products are differentiated.
4. Firm's degree of control over the price of the product is limited.
5. Method of marketing advertising and rivals price.
6. Every firm decides its own policy and price.

### 3.3.4 Comparison of Various Market Forms

| Characteristic          | Perfect competition             | Imperfect competition                      |   |  |
|-------------------------|---------------------------------|--|---|--|
|                         | Monopolistic competition        | Oligopoly                                  | Monopoly  |  |
| Number of firms         | Many                            | Many                                       | Few   | One  |
| Ability to affect price | None                            | Limited                                    | Some  | Considerable                                 |
| Entry barriers          | None (Free entry)               | None (Free entry)                          | Some (limited entry)                            | Complete (No entry)                          |
| Product type            | Homogeneous                     | Differentiated                             | Homogeneous                                     | Brand  |
| Marketing methods       | Commodity exchanges or auctions | Advertising quality and design differences | Advertising quality riverly administered prices | Promotional and public relations advertising |
| Example                 | Fruit stalls                    | Grocer                                     | Cars  | Post office                                  |

Diminishing number of sellers →

Market forms

### 3.3.3 Price Mechanism

- In a free market individuals are free to make their own economic decisions. Consumers are free to decide what to buy with their incomes, free to make demand decisions. Firms are free to choose what to sell and what production methods to use, free to make supply decisions. The resulting demand and supply decisions of consumers and firms are transmitted to each other through their effect on prices, through the **price mechanism**.
- The price mechanism works as follows. Prices respond to **shortage** and **surpluses**. Shortages cause prices to rise. Surpluses cause prices to fall.
- Consumers decide they want more of a good, demand will exceed supply. The resulting **shortage** will cause the **price of the good to rise**. This will act as an incentive to producers to supply more, since production will now be more

## Short Run & Long Run Cost Functions: 3

(25)

### Cost:

- Introduction: "cost may be defined in simple terms as a sacrifice (or) foregoing which has already occurred (or) has potential to occur in future with an objective to achieve a specific purpose measured in monetary terms.
- cost results in current (or) future decrease in cash (or) other assets, (or) a current (or) future increase in liability.
  - cost is determined by various factors and each of these has significant implications for cost decisions. An increase in any of these will affect cost pattern.

⇒ Mathematically we can express the cost function as:-

$$C = f(Q, T, P_f)$$

where  $C$  = Cost ;

$T$  = Technology

$Q$  = output

$P_f$  = price of inputs

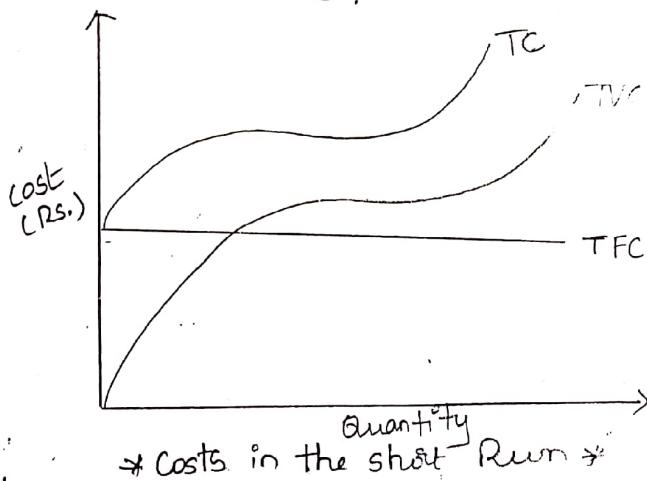
⇒ Cost in "SHORT RUN":-

- Another classification of costs is on the basis of time. The short run is a time period where some factors of production remain fixed and only few are variable.
- In the short run some inputs like land, machine and technology cannot be increased (or) decreased and output has to be increased by using additional units of variable input like labour and raw materials.

— Therefore in the short run we divide costs in two broad categories :   
       $\rightarrow$  fixed cost  
       $\rightarrow$  variable cost

$\Rightarrow$  Fixed Cost:

- These are costs that do not vary with output. Before a firm actually starts producing, it needs to spend on plant, machinery, fittings, equipments, etc., in fact, the firm has to bear these costs even if there is no output. These represents fixed costs.
- Since such costs do not vary with the level of output, any decision regarding volume of output does not depend upon fixed cost.
- The shape of the Total Fixed Cost (TFC) curve is given in figure as a straight line from the origin, Parallel to the quantity axis, indicating that output may increase to any level without causing any change in the fixed cost.



$\Rightarrow$  Variable Cost:

These are the costs that vary with output and are incurred in getting more and more inputs; variable costs are equal

- to zero if there is no output. Examples include cost of raw materials, wages, etc.

- more and more units of the variable factor are added in production its productivity goes on increasing.

- In the figure TVC curve is less steep in the beginning; as we increase the variable input, with the other input fixed, productivity of the variable input falls because of diminishing rate of technical marginal substitution between two inputs.

### Costs in Long Run:

- All costs are variable in the long run since factors of production, size of plant, machinery and technology are all variable. This in turn implies radical changes in the cost structure of the firm.

- The long run cost function is often referred to as the "planning cost function" and the long run average cost (LAC) curve is known as the "planning curve".

- The long run consists of many short runs. Eg. a week consists of seven days and a month consists of four weeks and so on.

- When the plant size and other fixed inputs of the firm increase in the long run, the short run cost curves (SAC) shift to the right.

