UNIT – III

THEORY OF PRODUCTION AND COST ANALYSIS

It is necessary that the managers need to know how much can be produced with a given set of inputs.

Production Function : The technical relationship which reveals the maximum amount of output capable of being produced by each and every set of inputs.

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

Q = Quantity of Production

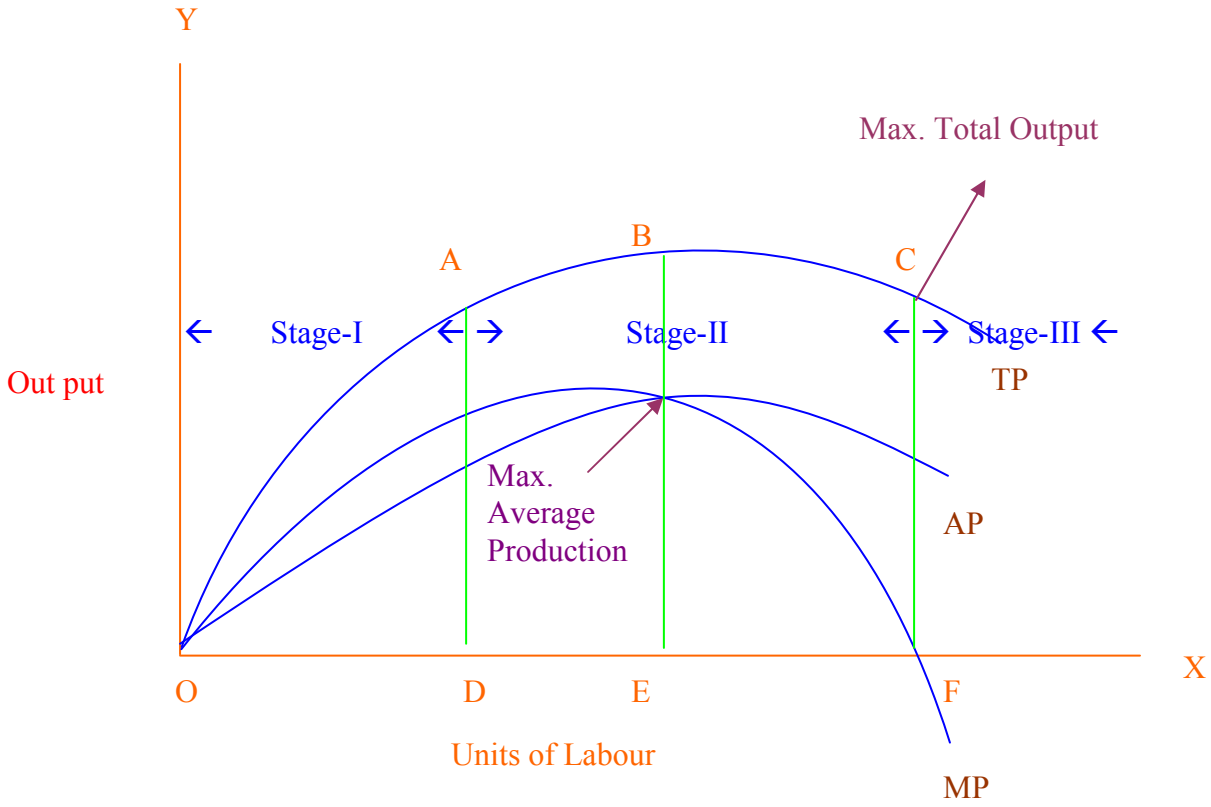
L_1 = Labour, L_2 = Land, C = Capital,

O = Organization, T = Technology

Production function with one variable input and law of returns : The laws of returns states that when at least one factor of production is fixed or factor input is fixed and all other factors are vertical, the total output in the initial stages will increase at an increasing rate, and after reaching certain level of output the total output will increase at declining rate, If variable factor inputs are added further to the fixed factor inputs are added further to the fixed factor input, the total output may decline, this law is universal nature and it proved to be true in agriculture and industry also, the law of returns is also called the law of variable proportions or the law of diminishing returns.

Output with fixed capital and variable labour inputs

Units of labour	Total production	Marginal Production	Average production	Stages
0	0	0	0	Stage – I
1	10	10	10	
2	22	12	11	
3	33	11	11	Stage - II
4	40	7	10	
5	45	5	9	
6	48	3	8	
7	48	0	6.85	
8	45	-3	5.62	Stage - III



Production function with two variable inputs and Law of Returns :

We have assumed that a firm increases its output either by using more of one input (Short – period) production function or by using more of all inputs (Long – period production function). We shall now concentrate on a firm which increases its outputs by using more of two inputs that are substitutes for each other say labour (L) and Capital (C). We can now conceive of the production function in terms of certain fixed inputs and two variable inputs.

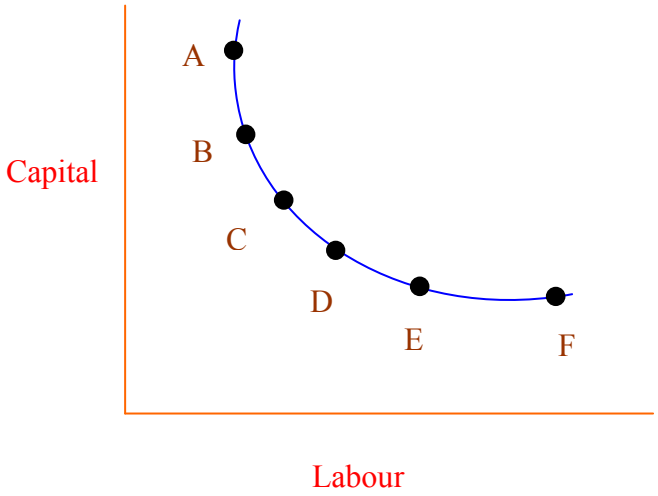
Out put form different combination of two inputs

No. of Machines ↓	Out Put			
8	30	35	40	45
6	25	30	35	40
4	20	25	30	35
2	15	20	25	30
No. of Workers →	2	4	6	8

Iso – Quants : Iso means equal, quant means quantities iso-quants means that the quantities throughout a given iso-quants are equal. Iso-quants also called, Iso-product curves or production indifference curves.

An iso-quants curve shows various combinations of two input factors such as capital and labour, which yield the same level of output.

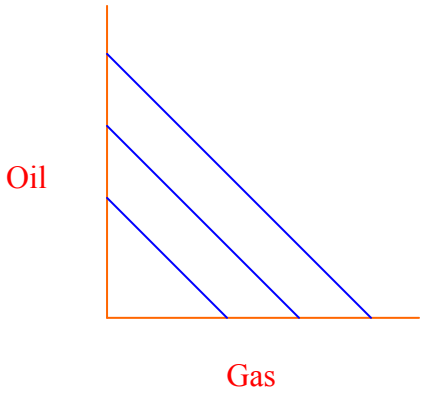
Combinations	Capital (C)	No. of Labourers (L)
A	1	20
B	2	15
C	3	11
D	4	8
E	5	6
F	6	5



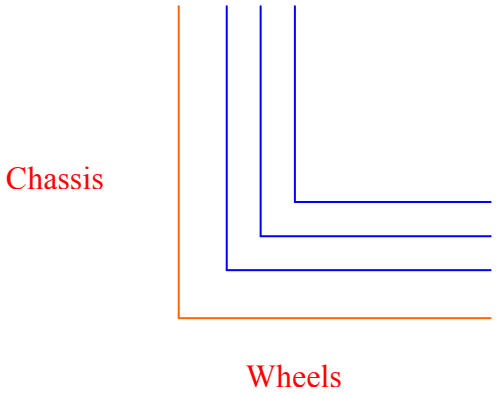
Type of Iso – Quants :

a) Linear Iso – Quant : Which iso-quants having perfect substitutability of inputs such a iso-quants we called as linear iso-quants

Ex: A power plant equipped to burn either Oil or Gas.

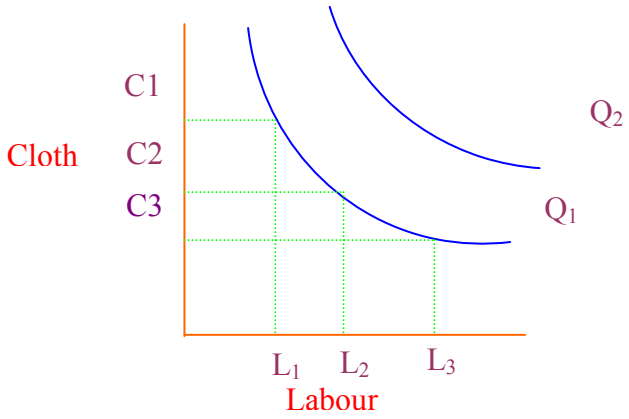


b) Right – Angle Iso – Quant : Where there is complete non-substitutability between the inputs such a iso-quants called as right – angel iso-qunats.



Ex : Exactly two wheels and one chassis are required to produce a scoter and in no way can wheels be substituted for chassis or vice-versa.

c) Convex Iso – Quant : This from assumes substitutability of inputs but the substitutability is not perfect.



Ex : A shirt can be made with relatively small amount of labour (L_1) and large amount of cloth (C_1). The same shirt can be as well made with less cloth (C_2), if more labour (L_2) is use because the tailor will have to cut the cloth more carefully and reduce wastage.

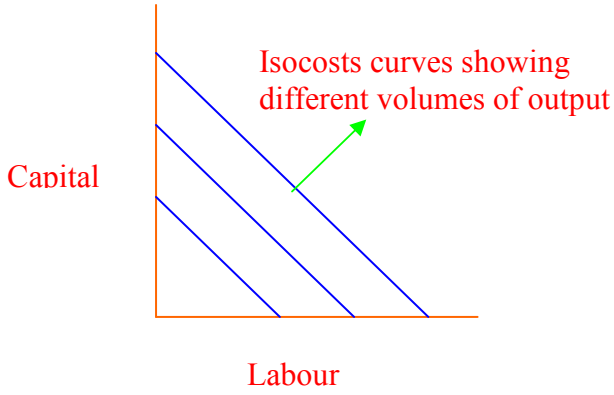
Marginal Rate of Technical Substitution (MRTS) :

Marginal Rate of Technical Substitution (MRTS) refers to the rate at which one input factor is substituted with the other attain a given level of output. In other words, the lesser units of one input must be compensated by increasing amounts of another input to produce the same level of output.

$$MRTS = \frac{Change\ in\ one\ input,\ say,\ Capital}{Change\ in\ another\ input,\ say,\ Labour}$$

Combinations	Capital (C)	No. of Labourers (L)	MRTS
A	1	20	-
B	2	15	5:1
C	3	11	4:1
D	4	8	3:1
E	5	6	2:1
F	6	5	1:1

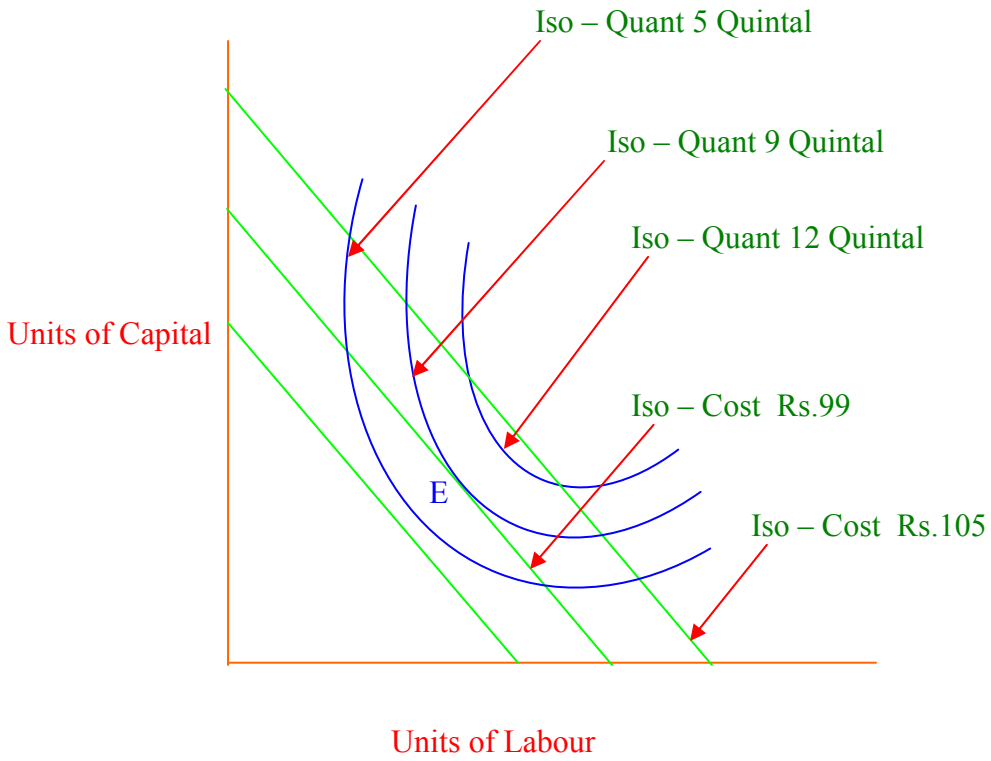
Isocosts : Isocost refers to that cost curve that represents the combination of inputs that will cost the producer the same amount of money. In other words, each isocost denotes a particular level of total cost for a given level of production. If the level of production changes, the total cost changes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



Least – Cost Combination of Inputs: In order to gain maximum profit the cost of production must be reduced. Isocost and Isoquants are used to determine input factors for minimizing cost of production at maximum output. This is known as Least – Cost Combination of Inputs. To explain how he can determine the least cost combination for given output, we need the price of the factors of production. Let the price of labour (P_L) be Rs.6 per unit and the price of capital (P_k) Rs.9 per unit. Assume that any amount of labour and capital can be bought at these respective fixed prices. Let our farmer wants to produce a certain amount of paddy. Assume that the farmer has certain combinations of labour and capital (tractor) given in the table below.

Combination	Input in units		Cost (Rs.)
	K	L	
1	3	20	(3 x 9) + (20 x 6) = 147
2	4	13	(4 x 9) + (13 x 6) = 114
3	5	10	(5 x 9) + (10 x 6) = 105
4	6	8	(6 x 9) + (8 x 6) = 102
5	7	6	(7 x 9) + (6 x 6) = 99
6	8	5	(8 x 9) + (5 x 6) = 102

In our example, there are six alternative combinations of labour and capital to produce the 9 quintals. Combination 5 represents the least cost for producing the desired produce. The least total cost producing various other quantities can be determined in a similar way Graphically we can determine the least cost input combination or the maximum output for a given cost, first we have to draw iso-quant map and than iso-cost map as shown below.



As per above figure the desired quantity of output can be produced at a least cost Rs.99 by having 6 units of capital and 7 units of labour. It is known by the point E where the iso-qunat curve is just tangent to the iso-cost curve (Rs.99). At any other point of iso-quant the total cost is more than Rs.99. Similarly for a given cost, an entrepreneur can select the best combination of two inputs which will give the maximum output by way of selecting that iso-quant curve which is just tangent to a given iso-cost curve.

Plant : Body of persons assembling together to work at a certain time and place.

Ex : Factors, Mills, Workshop, Warehouse, Retail shop

Firm : A firm is the unit which owns, controls, and manages the plant or plants. This term is used form the financial and administrative angle.

Industry : An industry is generally defined as group of firms producing the same or slightly different products for the same market or using same raw materials.

Ex : Automobile industry, Pharmaceutical industry and Rubber industry.

Cobb – Douglas Production Function :

Douglas and Cobb of USA author have developed a production function now widely used and found to be supported by empirical evidence.

"The Cobb and Douglas production function says that labour contributes about three – quarter of increase in manufacturing production and capital the remaining one – quarter ". It exhibits constant returns to scale and so it attracted the attention of economists.

$$\mathbf{Q = K L^{a} C^{(1-a)}}$$

Q = Output, L = Quantity of Labour

C = Quantity of Capital Employed

K and (1-a) are positive constant

a, (1-a) measures the elasticities of production that is a, (1-a) measures the percentage response of output to percentage changes in labour and capital respectively. The function as said, above is linear and homogeneous, suppose the quantities of labour and capital are increased in equal proportions.

Let "L" becomes gL

Let "C" becomes gC

$gQ = g (K L^{a} C^{(1-a)})$

$R.H.S = K ((gL)^{a} (gC)^{(1-a)})$

$= (g^{a} g^{(1-a)}) (K L^{a} C^{(1-a)})$

$= (g) (K L^{a} C^{(1-a)})$

$= g Q$

L.H.S = R.H.S

The output increases in the same proportion returns to scale are constant.

Return to Scale and Return to Factors :

Return to Scale refer to the returns enjoyed a firm as a result of change in all the inputs. It explains the behavour of the returns when the inputs are changed simultaneously. The return to scale are governed by laws of returns to scale.

C	L	% Increase in both inputs	Output	% Increase in Output	Law
1	3	-	50	-	-
2	6	100	120	140	Law of Increasing Returns to Scale
4	12	100	240	100	Law of Constant Returns to Scale
8	24	100	360	50	Law of Decreasing Returns to Scale

Economies of Scale : When production is done on large scale, the average cost of production reduces, it is called as economies of scale. There exists two forms of economies of scale.

1. Internal Economies 2. External Economies

Internal Economies : The internal economies refers to the benefits enjoyed when the firm increases its size and output (Production).

Classification of Internal Economies :

1) Technical Economies : Technical Economies can be achieved because of adopting better techniques of production, use of powerful machineries, employing specialized technical know how use of new technology for production process increases the volume of production and reduces wastages.

2) Managerial Economies : Managerial economies are achieved from creating special departments, creating functional specialization, delegation of responsibilities. In large scale production managers are required for separate departments. Their functional specialization leads to minimum wastages, optimum use of resources therefore the cost of production becomes low.

3) Commercial Economies : Commercial economies arises due to bulk purchase of materials, bargaining advantage and sales of goods. When raw materials and spares are purchased on large quantities, there is huge savings in cost of material, cost of procurement, transportation and storage costs. These factor further reduces the cost of production and increases profits.

4) Financial Economies : Financial economies arises from the fact that a big firm has better credit and can borrow at more favorable rates. Share of this company enjoy wider market and encourages prospective investors.

5) Risk Bearing Economies : The large firms produce many commodities and serve wider areas. It is, therefore, able to absorb any shock for its existence. For example, during business depression, the prices fall for every firm. There is also a possibility for market fluctuations in a particular product of the firm.

6) Marketing Economies : A large company can maintain a professional marketing division for various related activities such as customer surveys, effective advertising and sale promotion.

7) R & D Economies : Large organizations can set up and spend money and separate research and development activities for making innovative products. This very important for survive in global competition.

External Economies : External economies refers to the benefits of the firms which are not dependent on size of the firm and also not on products. External economies benefit all the firms in the industry.

Classification of External Economies :

1) Economies of Concentration: Economies of concentration is due to advantages from availability of skilled labour, better transport, credit facilities. Scattered firm can not avail these benefits.

2) Economies of Information : The economies of information refers to the benefit to the firm by trade journal advertisement, technical journal and technical know how form research institutes.

3) Economies of Disintegration : The firms in an industry may also reap the economies of specialization. When an industry expands, it becomes possible to split up some of the processes, which are taken over by specialist firms.

4) Economies of Welfare : An industry is in a better position to provide welfare facilities to the workers. It may get land at concession rates and procure special facilities from the local bodies for setting up housing colonies for the workers. It may also establish public health care units, educational institutions both general and technical so that a continuous supply of skilled labour is available to the industry. This will help the efficiency of the workers.

COST ANALYSIS

Profit is the ultimate aim of any business and the long-run property of a firm depends upon its ability to earn sustained profits. Profit is the difference between the selling price and cost of production, in general the selling price is not within the control of a firm but many costs are under its control. The firm should therefore aim at controlling and minimizing cost and maximizing the profit.

Cost Concepts : The kind of cost concept to be used in particular situation depends upon the business to be made cost considerations enter into almost every business decision, and it is important, though sometimes difficult, to use the right kind of cost. Hence an understanding of the meaning of various concepts is essential for clear business thinking.

Different Type of Cost Concepts :

Actual cost & Opportunity Cost :

Actual cost means the actual expenditure incurred for acquiring or producing goods or services **Ex:** Wages paid, Cost of material purchased.

Opportunity cost of a goods or service is measured in terms of revenue which could have been earned by employing that goods or service in some other alternative uses. Opportunity cost can be defined as the revenue foregone by not making the best alternative uses.

Ex: If start a business in the central locality area of the town we lease a shop after paying some amount to the shop owner. The amount and interest on amount is opportunity cost.

Explicit and Implicit or Imputed cost :

Explicit cost are those expense that involve cash payments these are the actual or business costs that appears in the books of accounts. Explicit cost is the payment made by the employed for those factors of production hired by him from outsides. **Ex:** Wages, salaries, raw material

Implicit costs are the costs of the factor units that are owned by the employer himself. It does not involve cash payment and hence does not appear in the books of accounts. These costs are not actually incurred but would have been incurred in the absence of employment of self-owned factors.

Ex: Rent unclaimed on own building, Depreciation.

Historical and Replacement costs :

Historical cost valuation shows the cost of an asset as the original price paid for the asset acquired in the past. Historical valuation is the basis for financial accounts.

Replacement cost is the price that would have to be paid currently to replace the same asset.

Ex: Price of a machine at the time of purchase was Rs.17,000 and the present price of the machine is Rs.20,000

17,000 - Historical Cost

20,000 - Replacement Cost

Short – run and Long – run cost : Short run is a period during which the physical capacity of the firm remains fixed. Any increase in output during this period is possible only by using the existing physical capacity more intensively. But in the long – run it is possible to change the firms physical capacity as all the inputs are variable in the long – run. Short – run cost is that varies with output when the plant and capital equipment remain constant.

Out – of Pocket and Book Cost :

Out of pocket costs, also know as explicit cost are those costs that involve current cost payment **Ex:** wages, rent and interest etc.

Book costs also called implicit cost do not require current cash expenditure. **Ex:** Unpaid salary of the owner manager, depreciation and unpaid interest.

Past cost and Future cost :

Past cost also called historical costs are the actual costs incurred and recorded in the books of accounts.

Future costs are costs that are expected to be incurred in the future.

Traceable cost and Common cost :

Traceable cost otherwise called direct cost in one which can be identified with a production process or product **Ex:** Raw material cost

Common costs are the ones that cannot be attributed to a particular process or product **Ex:** Salaries paid.

Avoidable cost and Unavoidable cost:

Avoidable costs are those which will be eliminated. If a segment of the business with which they are directly related, is discontinued.

Ex: Salary of clerks attached to the product or bad debts, traceable to the

product would be eliminated.

Unavoidable costs are those which will not be eliminated with the segment. Such costs are merely reallocated if the segment is discontinued.

Ex: In case a product discontinued, the salary of the factory manager or factory rent can not be eliminated.

Controllable cost and Uncontrollable cost :

Controllable costs are those costs which can influenced by the action of specified member of an undertaking. Costs which cannot be so influenced are termed as uncontrollable costs.

Ex: The expenditure incurred by tool room is controlled by the Foreman –

In-charge of that section but the share of the tool room expenditure, Which is apportioned to a machine shop can not be controlled by a Machine shop-foreman.

Incremental cost and Sunk cost :

This additional cost due to a change in the level or nature of business activity, the changes may be used by adding a new product, adding new

machinery, replacing a machine by a better one etc. Incremental or differential cost is not marginal cost. Marginal cost is the cost of additional unit of output. Marginal costs involve only variable cost, where as incremental cost includes both variable and fixed cost.

Sunk costs are those which are not altered by any change in the level or nature of business activity, they are the costs incurred in the past. This cost is the result of past decision and cannot be changed by future decisions.

Ex: Investment in fixed asset is sunk cost.

Fixed cost, Variable cost and Semi-variable cost :

Which cost is fixed up to certain level of output such a cost is called as fixed cost **Ex:** Machinery cost

Which cost is vary with production such as cost is called as variable cost

Ex: Raw material cost

This cost neither fixed cost nor variable cost such a cost called as semi-variable cost. **Ex:** Telephone bill

Total cost, Average cost and Marginal cost :

Total cost is the total cash payment made for the input needed for production. It is the sum total of the fixed and variable costs.

Average cost is cost per unit of production. **AC = TC/Q**

Marginal cost is the additional cost incurred to produce an additional output. **MC = ΔTC/ΔQ**

Accounting cost and Economic Cost :

Accounting costs are the costs recorded for the purpose of preparing the balance sheet and profit & loss statements to meet legal, financial and tax purposes of the company.

Economic concept considers future costs and future revenues which help future planning and choices.

Abandonment cost : Abandonment costs are the cost of retiring altogether a plant from service, abandonment arises when there is a complete cessation of activities and creates a problem as to the disposal of assets.

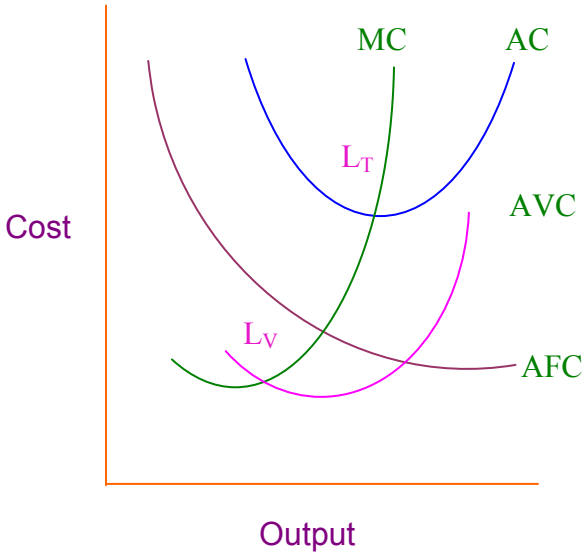
Ex: The costs involved in the discontinuance of tram services in Mumbai and Delhi.

Cost Output relations:

Short – Run Cost Output Relation: In this period of time within, which firm can vary its output by varying only the amount of variable factors, such as labour and raw materials, In the short-run fixed factors, such as capital equipment and to management personnel etc. can not be varied.

Units	TFC	TVC	TC	AFC	AVC	AC	MC
0	30	0	30	-	-	-	-
1	30	10	40	30	10	40	10
2	30	18	48	15	9	24	8
3	30	24	54	10	8	18	6
4	30	32	62	7.5	8	15.5	8
5	30	50	80	6	10	16	18
6	30	72	102	5	12	17	22

The cost output relationships can also be shown through the use of graphs. It will be seen that the average fixed cost curve(AFC) falls as output rises from lower levels to higher levels. The shape of the average fixed cost curve therefore, is rectangular hyperbola. The average variable cost curve (AVC) first falls and then rises. So also the average total cost curve (AC). However, the AVC curve stats rising earlier than the AC curve and not to the point L_V which lies on the AVC curve. Another important point to be noted is that the marginal cost curve (MC) intersects both the AVC and the AC curve at their minimum points. This is very simple to explain. If marginal cost is less than the average cost, it will pull AC down. If the MC is greater than AC, it will pull AC up. If the MC is equal to AC, it will neither pull AC up nor down. Hence MC curve tends to intersect the AC



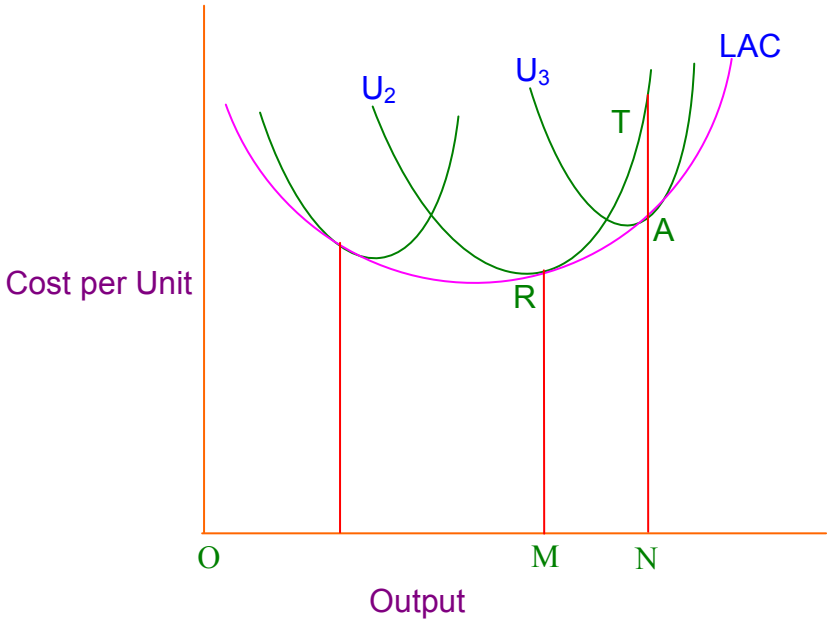
curve at its lowest point. Similar is the position about the average variable cost curve.

The rate of change in MC is greater than that in AVC and hence the minimum MC is at an output lower than the output at which the AVC is the minimum. The AC falls for a larger range of output than AVC and hence the minimum AC is at a larger output than the minimum AVC.

The inter-relationships between AVC, AC and AFC can be summed up as follows:

1. If both AFC and AVC fall, AC will fall.
2. If AFC falls but AVC rises:
    a) AC will fall where the drop in AFC is more than the rise in AVC
    b) AC will not fall where the drop in AFC is equal to the rise in AVC
    c) AC will rise where the drop in AFC is less than the rise in AVC

Long – Run Cost Output Relation : In output are possible only within the range permitted by the existing fixed plant and equipment. But in the long run the entrepreneur has before him a number of alternatives which include the construction of various kinds and size of plants.



U_1 = Short-run average cost curve-1

U_2 = Short-run average cost curve-2

U_3 = Short-run average cost curve-3

LAC = Long-run average cost curve

At OM output average cost is U_2, now desire to produce ON output. If the firm continues under the old scale, its average cost will be NT. If the scale of the firm altered, new cost curve would be U_3. The average cost of producing ON would be NA. NA is less than NT so the new scale is preferable to the old one and should be adopted.

Break – Even – Analysis : Break even analysis is defined as analysis of costs and their possible impact on revenues and volume of the firm. Hence it is also called as Cost – Volume – Profit (CVP) analysis. A firm is said to attain the break even point (BEP) when its total revenue is equal to total cost.

Key Terms used in Break-even Analysis:

Fixed cost : Fixed costs remain fixed in the short-run, Examples are rent insurance, depreciation factory supervisors' salaries, and so on

Variable cost : The variable cost per unit vary with the volume of production. The variable costs include cost of direct materials, direct labour, direct expenses, operating supplies such as lubricating oil, and so on.

Total Cist : The total of fixed and variable costs

Total revenue: The sales proceeds (Selling price per unit x number of units sold) **Contribution margin:** The contribution margin is the difference between the selling price per unit and the variable cost per unit. It is also determined as (Fixed cost per unit + profit per unit)

Profit = Contribution – Fixed cost

Contribution margin ratio: It is the ratio between contribution per unit and the selling price per unit.

Margin of safety in units: The excess of actual sales (in units) minus the break-even point (in units)

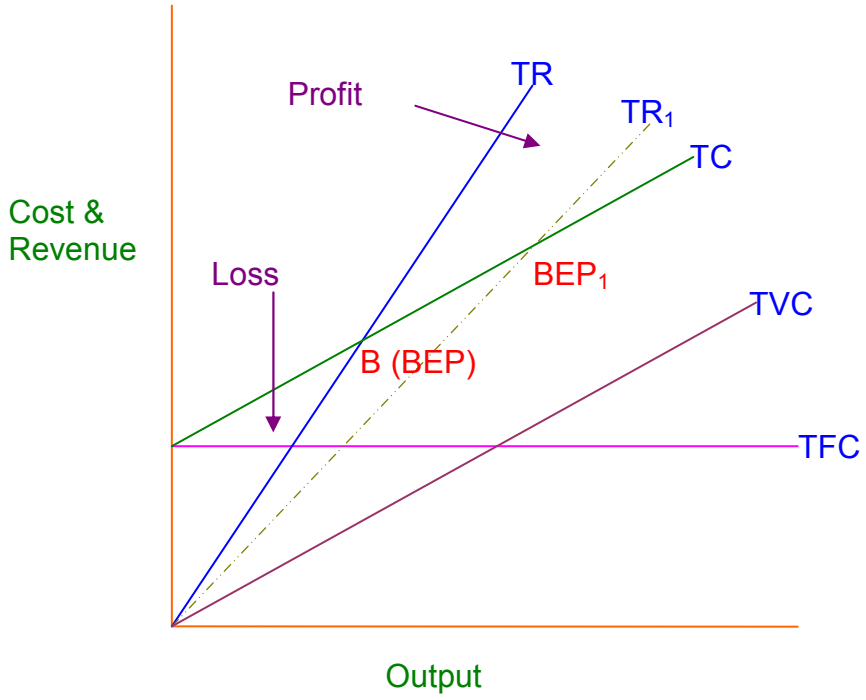
Margin of safety in sales volume: The excess of actual sales (in rupees) minus the break-even point (In rupees)

Angle of incidence: The angle formed where total cost curve cuts the total revenue curve

Break – even chart : The break-even analysis can be presented graphically too. The break-even chart is the graphic presentation of the varying costs along with varying sales revenue. It indicates the break-even point and also shows the estimated profit or loss at different levels of production. A break-even char can be drawn with the data as per table below.

Output	Fixed cost	Variable cost	Total cost	Sales	Proposed sales
0	200000	-	200000	-	-
10000	200000	100000	300000	200000	180000
20000	200000	200000	400000	400000	360000
30000	200000	300000	500000	600000	540000
40000	200000	400000	600000	800000	720000
50000	200000	500000	700000	1000000	900000
60000	200000	600000	800000	1200000	1080000

The OX axis shows the units of output and OY axis shows the cost and sales revenue. Fixed cost line is parallel to OX axis. This shows that the fixed cost is same Rs.200000 even when the production is zero unit or 10000 units. The variable cost line is drawn over the fixed cost line in the OY axis. As this is drawn over the fixed cost line this also the total cost(TC) line. Sales (TR) line starts from zero and goes upwards showing increase in revenue with the increase in sales. The firm breaks even at the point where TC line and TR line intersects the point B. At this point the firm is not making any profit or loss. Any sales above the point B will bring in profit and sales below this point will result only in loss.



Significance of Break-Even Analysis :

- To ascertain the profit on a particular level of sales volume or a given capacity of production
- To calculate sales required to earn a particular desired level of profit

- To compare the product lines, sales area, method of sale for individual company
- To compare the efficiency of the different firm
- To decide whether to add a particular product to the existing product line or drop one from it
- To decide to make or buy a given component or spare part
- To decide what promotion mix will yield optimum sales
- To asses the impact of changes in fixed cost, variable cost or selling price on BEP and profits during a given period.

Break – Even Point : The break-even point is that junction where income and cost are exactly in balance. Thus there is neither profit nor loss for that particular volume of production.

$$BEP\ in\ Units = \frac{Fixed\ Cost}{Selling\ Price\ per\ Unit - Varibale\ Cost\ per\ unit}$$

$$BEP\ in\ Rupees = \frac{Fixed\ Cost}{Selling\ Price\ per\ Unit - Varibale\ Cost\ per\ unit} \times Selling\ Price\ per\ unit$$

$$Sales\ required\ to\ earn\ a\ desired\ profit\ (in\ units) = \frac{Fixed\ cost + Desired\ Profit}{Selling\ Price\ per\ Unit - Varibale\ Cost\ per\ unit}$$

Profit – Volume Ratio (P/V) : P/V ratio measure the profitability in relation to sales and contribution it also called contribution to sales (C/S) ratio. The contribution at given output is defined to be the difference between total sales and total variable costs. It represents the relationship between contribution and turn-over. So it is a measure to compare profitability of different products. Higher the p/v ratio is preferable product.

$$P/V\ Ratio = \frac{Contribution}{Sales} \times 100$$

$$P/V\ Ratio = \frac{Fixed\ Cost + Profit}{Sales} \times 100$$

$$P/V\ Ratio = \frac{Changes\ in\ profit}{Changes\ in\ sales} \times 100$$

$$P/V\ Ratio = \frac{Fixed\ Cost}{P/V\ Ratio} \times 100$$

Margin of Safety : The Margin of Safety (MOS) is the difference between the actual sales and BEP sales. This is helps to know how much sales revenues can fall before a loss is incurred.

MOS = Actual Sales – Break-even sales

$$MOS\ Ratio = \frac{\text{Actual Sales - Break even sales}}{Actual\ Sales} \times 100$$

$$MOS\ Ratio = \frac{\text{Pr}ofit}{P/V\ Ratio}$$

Problems :

1. If sales are 10,000 units and selling price is Rs.20 per unit, variable cost Rs.10 per unit and fixed cost is Rs.80, 000. Find out BEP in units and in sales revenue. What is profit earned? What should be the sales for earning a profit of Rs.60,000.

Solution:

Quantity	=	10,000 units
Selling Price	=	Rs. 20 per unit
Variable Cost	=	Rs.10 per unit
Fixed Cost	=	Rs.80,000
Profit	=	Rs.60,000

a) Break even points (in units) is given by

$$BEP\ in\ Units = \frac{Fixed\ Cost}{Selling\ \text{Pr}ice\ per\ Unit - Varibale\ Cost\ per\ unit}$$

$$BEP\ in\ Unirs = \frac{80{,}000}{20-10}$$

BEP in Units = 8000 units

b) Break-even point in rupees in given by

$$BEP\ in\ Rupees = \frac{Fixed\ Cost}{Selling\ \text{Pr}ice\ per\ Unit - Varibale\ Cost\ per\ unit} \times Selling\ \text{Pr}ice\ per\ unit$$

$$BEP\ in\ Rupees = \frac{80{,}000}{20-10} \times 20$$

BEP in Rupees = 1,60,000/-

c) Profit earned is given by

Profit = Total Contribution – Fixed cost

And contribution per unit = Selling price – Variable cost

Total Contribution = (Selling price – Variable cost) x Number of units sold.

= (20 – 10) x 10,000

= Rs.100000/-

Profit earned = Total contribution – Fixed cost

= 100000 – 80000

Profit = 20000/-

d) Sales for earning profit of Rs.60,000/-

$$Sales\ required\ to\ earn\ a\ desired\ profit\ (in\ units) = \frac{Fixed\ \cos t + Desired\ \Pr ofit}{Selling\ \Pr ice\ per\ Unit - Varibale\ Cost\ per\ unit}$$

$$Sales\ required\ to\ earn\ 60{,}000\ \Pr ofit = \frac{80{,}000 + 60{,}000}{20-10}$$

= 14000 units.

2. The PV ratio of Matrix Books ltd. Is 40% and margin of safety is 30%. Your are required to workout the BEP and Net profit of the sales volume is Rs,14000/-

Solution:

PV ratio	=	40%	=	0.4
Margin of safety	=	30%	=	0.3
Sales volume	=	Rs.14000		

a) BEP is given by

BEP = Sales volume – Margin of Safety

BEP = 14,000 – (30% of 14000) = 14000 – 4200

BEP = Rs. 9800/-

b) Net profit is given by

Net Profit = Margin of safety x PV ratio

Net Profit = 4200 x 0.4

Net Profit = Rs.1680/-

3. Sale of a product amounts to 20 units per month Rs.10 per unit fixed overheads are Rs. 400 per month and variable cost is Rs.6 per unit. There is a proposal to reduce prices by 10%. Calculate present and future PV ratio.

Solution :

Sales	=	20 units
Selling price	=	Rs.10 per unit
Fixed cost	=	Rs.400
Variable cost	=	Rs.6 per unit

Present PV ratio :

$$P/V\ Ratio = \frac{Contribution}{Sales} \times 100$$

$$P/V\ Ratio = \frac{10-6}{10} \times 100 = 40\%$$

Future PV ratio:

Selling price is reduced by 10% hence future selling

Rs.10 – Rs.1 = Rs.9/-

Variable cost remains same i.e., Rs.6/- per unit

$$P/V\ Ratio = \frac{Contribution}{Sales} \times 100$$

$$P/V\ Ratio = \frac{9-6}{9} \times 100 = 33.33\%$$

4. Sales of Rs.1,10,000 producing a profit of Rs.4000 in period – I. Sales of Rs.1,50,000 producing a profit of Rs.12,000 in period – II. Determine BEP and Fixed expenses.

Solution :

Period	Sales	Profit
I	1,10,000	4,000
II	1,50,000	12,000

BEP is given by

$$P/V\ Ratio = \frac{Changes\ in\ profit}{Changes\ in\ sales} \times 100$$

$$P/V\ Ratio = \frac{12000 - 4000}{150000 - 110000} \times 100$$

$$P/V\ Ratio = \frac{8000}{40000} \times 100 = 20\%$$

Fixed Cost = (Sales x PV ratio) – Profits

= (110000 x 0.20) – 4000

= Rs.18,000/-

Now BEP = $\frac{Fixed\ Cost}{P/V\ Ratio} \times 100$

= $\frac{18000}{0.20} = Rs.90{,}000$

5. A gear manufacturing company sells gears at a selling price of Rs.250 per unit. The company has fixed cost commitment at Rs.20 lakhs and variable cost of Rs.125/- per unit calculate.

a) Break-even sales quantity b) Break-even sales c) Contribution d) Margin of safety if actual production quantity is 60,000 units.

Solution :

Selling price	=	Rs.250/- per unit
Variable cost	=	Rs.125/- per unit
Fixed cost	=	Rs.20,00,000/-

a) BEP:

$$BEP\ in\ Units = \frac{Fixed\ Cost}{Selling\ \text{Pr}ice\ per\ Unit - Varibale\ Cost\ per\ unit}$$

$$BEP\ in\ Units = \frac{20,00,000}{250 - 125}$$

= 16,000 units

b) **Break-even sales = BEP in Units x Selling price per unit**

= 16,000 x 250

= 40,00,000/-

c) **Contribution Margin = (Selling price – Variable cost)**

= 250 – 125 = Rs.125/-

Since contribution margin per unit = Rs.125/-

Total contribution margin for 60,000 units = Rs.125 x 60,000

= Rs.75,00,000/-

d) Margin of Safety

Margin of Safety = Budgeted sales – sales at BEP

= (60,000 x 250) – (16000 x 250)

= 15000000 – 4000000

= 1100000/-