UNIT –II

THEORY OF PRODUCTION AND COST ANALYSIS

Production Function:-

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 (L1,L2,C,O,T)

Where "Q" stands for the quantity of output and various input factors such as L1 as land, L2 as labour, C is capital ,O is organization and T is technology.. Here output is the function of inputs. Hence output becomes the dependent variable and inputs are the independent variables.

Definition

Michall R. Baye "the function which defines the maximum amount of output that can be produced with a given set of inputs."

Isoquants

An isoquant is a curve representing the various combinations of two inputs that produce the same amount of output. An isoquant curve is also known as iso-product curve, equal-product curve and production indifference curve. A curve which shows the different combinations of the two inputs producing a given level of output.

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

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. If we plot all these combinations on a paper and join them, we will get continues and smooth curve called Iso-product curve as shown below.
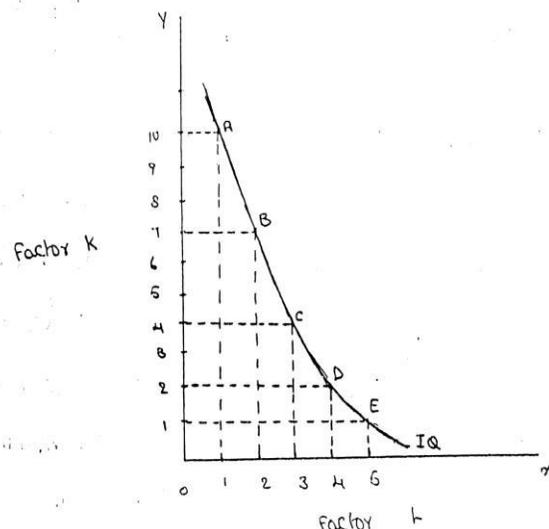
Labour is on the X-axis and capital is on the Y-axis. IQ is the ISO-Product curve which shows all the alternative combinations A, B, C, D, E which can produce 50 quintals of a product.

Features of Isoquant

1. **Downward sloping-** Isoquants are downward sloping curves because, if one input increases, the other one reduces. There is no question of increase in both the inputs to yield a given output. A degree of substitution is assumed between the factors of production.

2. **Convex to origin-** Isoquants are convex to the origin. Because the input factors are not perfect substitutes. One important factor can be substituted by the other input factor in a **"Diminishing marginal rate."**

3. If the input factors were perfect substitutes, the isoquants be a falling straight line.**Do not intersect-** Two isoproducts do not intersect with each other.
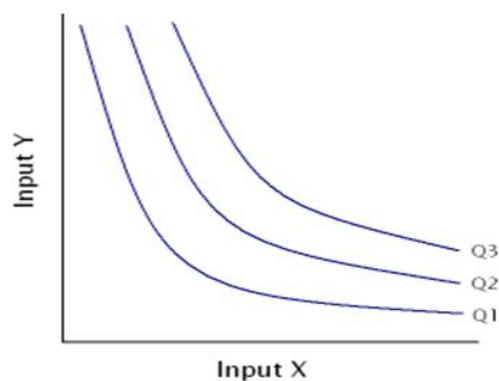
Fig. An Isoquant Map

Do not touch axes- The isoquants touches neither X-axis nor Y-axis, as both inputs are required to produce a given product

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Marginal Rate of Technical Substitution (MRTS):

Definition:

Prof. R.G.D. Alien and J.R. Hicks introduced the concept of MRS (marginal rate of substitution) in the theory of demand. The similar concept is used in the explanation of producers' equilibrium and is named as **marginal rate of technical substitution (MRTS).**

Marginal rate of technical substitution (MRTS) is: "The rate at which one factor can be substituted for another while holding the level of output constant**"**. The slope of an isoquant shows the ability of a firm to replace one factor with another while holding the output constant. For example, if 2 units of factor capital (K) can be replaced by 1 unit of labor (L), marginal rate of technical substitution will be thus:

Formula:

$MRTS_{LK} = \Delta K \diagup \Delta L$

combination	Capital (Rs. In lakh)	Labour	Marginal rate of technical substitutuion(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

It means that the marginal rate of technical substitution of factor labor for factor capital (K).(MRTSLK) is the number of units of factor capital (K) which can be substituted by one unit of factor labor (L) keeping the same level of output.

ISOCOSTS

The cost curve that represents the combination of inputs that will cost the producer the same amount of money **(or)** 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 Factor Combination Of Inputs :

The firm can achieve maximum profits by choosing that combination of factors which will cost it the least. The choice is based on the prices of factors of production at a particular time. The firm can maximize its profits either by maximizing the level of output for a given cost or by minimizing the cost of producing a given output.

- The least cost factor combination can be determined by imposing the isoquant map on isocost line.
- The point of tangency between the isocost and an isoquant is an important but not a necessary condition for producer's equilibrium.
- The essential condition is that the slope of the isocost line must equal the slope of the isoquant.
- Thus at a point of equilibrium marginal physical productivities of the two factors must be equal the ratio of their prices.
- Isoquant must be convex to the origin. The marginal rate of technical substitution of labour for capital must be diminishing at the point of equilibrium.
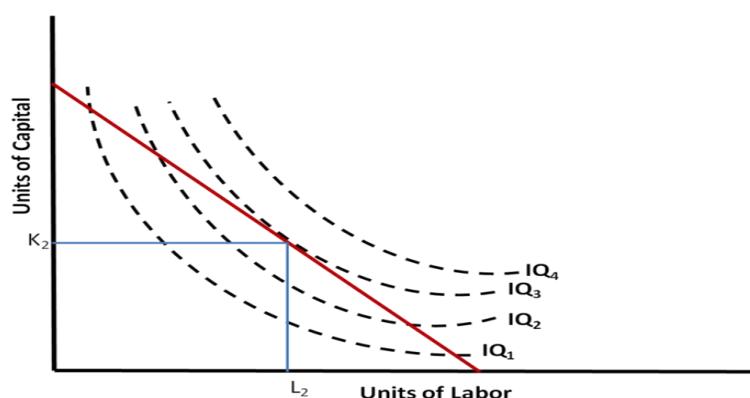
Cobb-Douglas production function:

Production function of the linear homogenous type is invested by Junt wicksell and first tested by C. W. Cobb and P. H. Dougles in 1928. This famous statistical production function is known as Cobb-Douglas production function. Originally the function is applied on the empirical study of the American manufacturing industry. Cobb – Douglas production function takes the following mathematical form.

$$Y= (AK^X L^{1-x})$$

Where Y=output,K=Capital,L=Labour

Assumptions:

It has the following assumptions

1. The function assumes that output is the function of two factors viz. capital and labour.
2. It is a linear homogenous production function of the first degree
3. The function assumes that the logarithm of the total output of the economy is a linear function of the logarithms of the labour force and capital stock.
4. There are constant returns to scale
5. All inputs are homogenous
6. There is perfect competition
7. There is no change in technology

Law of Returns

Laws of returns to scale refer to the long-run analysis of the laws of production. In the long run, output can be increased by varying all factors. Thus, in this section we study the changes in output as a result of changes in all factors. In other words, we study the behavior of output in response to changes in the scale. When all factors are increased in the same proportion an increase in scale occurs.

Types of returns to scale: constant, increasing and decreasing.

.1. Constant Returns to Scale : If output increases in the same proportion as the increase in inputs, returns to scale are said to be constant. Thus, doubling of all factor inputs causes output; tripling of inputs causes tripling of output to scale is sometimes called linear homogenous production function.

2. Increasing returns to scale : When the output increases at a greater proportion than the increase in inputs, returns to scale are said to be increasing. Scale are increasing, the distance between successive isoquants becomes less and less, that is, Oa >ab >bc. It means that equal increases in output are obtained by smaller and smaller increments in inputs. In other words, by doubling inputs the output is more than doubled.

3. Decreasing returns to scale : When the output increases in a smaller proportion than the increase in all inputs returns to scale are said to be decreasing. In other words, if the inputs are doubled, output will

increase by less than twice its original level. The decreasing returns to scale are caused by diseconomies of large scale production.

ECONOMIES OF SCALE

Marshall has classified these economies of large-scale production into internal economies and external economies.

Internal economies are those, which are opened to a single factory or a single firm independently of the action of other firms. Hence internal economies depend solely upon the size of the firm and are different for different firms.

External economies are those benefits, which are shared in by a number of firms or industries when the scale of production in an industry or groups of industries increases. Hence external economies benefit all firms within the industry as the size of the industry expands.

Internal Economies:

Internal economies may be of the following types.

A). Technical Economies:

Technical economies arise to a firm from the use of better machines and superior techniques of production. As a result, production increases and per unit cost of production falls. A large firm, which employs costly and superior plant and equipment, enjoys a technical superiority over a small firm.

. B). Managerial Economies:

These economies is developed in a firm or they tremendously growth developed and also expand the firm or organization they need qualified persons to handling each functional specialists. For example-Marketing, HR, Finance, Operation etc., on these persons experience the firm will developed and also they can reduce the wastage and increasing production in the long-run.

C). Marketing Economies:

The large firm reaps marketing or commercial economies in buying its requirements and in selling its final products. The large firm generally has a separate marketing department. It can buy and sell on behalf of the firm, when the market trends are more favorable. In the matter of buying they could enjoy advantages like preferential treatment, transport concessions, cheap credit, prompt delivery and fine relation with dealers. Similarly it sells its products more effectively for a higher margin of profit.

D). Financial Economies:

The large firm is able to secure the necessary finances either for block capital purposes or for working capital needs more easily and cheaply. It can barrow from the public, banks and other financial institutions at relatively cheaper rates. It is in this way that a large firm reaps financial economies.

E). Risk bearing Economies:

The large firm produces many commodities and serves 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. Under such circumstances the risk-bearing economies or survival economies help the bigger firm to survive business crisis.

F). Economies of Research:

A large firm possesses larger resources and can establish it's own research laboratory and employ trained research workers. The firm may even invent new production techniques for increasing its output and reducing cost.

G). Economies of welfare:

A large firm can provide better working conditions in-and out-side the factory. Facilities like subsidized canteens, crèches for the infants, recreation room, cheap houses, educational and medical facilities tend to increase the productive efficiency of the workers, which helps in raising production and reducing costs.

External Economies.

Business firm enjoys a number of external economies, which are discussed below:

A). 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 and communications, banking and financial services, supply of power and benefits from subsidiaries. All these facilities tend to lower the unit cost of production of all the firms in the industry.

B). Economies of Information

The industry can set up an information centre which may publish a journal and pass on information regarding the availability of raw materials, modern machines, export potentialities and provide other information needed by the firms. It will benefit all firms and reduction in their costs.

C). Economies of Welfare:

An industry is in a better position to provide welfare facilities to the workers. It may get land at confessional 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.

Thus internal economies depend upon the size of the firm and external economies depend upon the size of the industry.

COST   ANALYSIS :

Profit is the ultimate aim of any business and the long-run prosperity of a firm depends upon its ability to earn sustained profits.. 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. Since every business decision involves cost consideration, it is necessary to understand the meaning of various concepts for clear business thinking and application of right kind of costs.

COST CONCEPTS:

1. Opportunity Cost Vs Outlay Cost:

Opportunity cost implies the earnings foregone on the next best alternative, has the present option is undertaken. This cost is often measured by assessing the alternative, which has to be scarified if the particular line is followed. The opportunity cost concept is made use for long-run decisions.

2. Fixed and variable costs:

Fixed cost is that cost which remains constant for a certain level to output. It is not affected by the changes in the volume of production. But fixed cost per unit decrease, when the production is increased. Fixed cost includes salaries, Rent, Administrative expenses depreciations etc.

Variable cost is that which varies directly with the variation is output. An increase in total output results in an increase in total variable costs and decrease in total output results in a proportionate decline in the total variables costs. The variable cost per unit will be constant. Ex: Raw materials, labour, direct expenses, etc.

3.Explicit and Implicit costs:

Explicit costs are those costs that involve an actual payment to other parties. Therefore, an explicit cost is the monitory payment made by a firm for use of an input owned or controlled by others. Explicit costs are also referred to as accounting costs.

 Implicit costs represent the value of foregone opportunities but do not involve an actual cash payment. Implicit costs are just as important as explicit costs but are sometimes neglected because they are not as obvious.

4. Out-of-pocket costs and Book costs

Out of pocket costs are those costs that improve current cash payments to outsiders. The out-of-pocket costs are also called explicit costs. For example, wages and salaries paid to the employees are out-of pocket costs. Other examples of out-of-pocket costs are payment of rent, interest, transport charges, etc

Book costs are those business costs, which do not involve any cash payments but for them a provision is made in the books of account to include them in profit and loss accounts and take tax advantages. Book costs are called implicit or imputed costs.

5.Post and Future costs:

Post costs also called historical costs are the actual cost incurred and recorded in the book of account these costs are useful only for valuation and not for decision making.

Future costs are costs that are expected to be incurred in the futures. They are not actual costs. They are the costs forecasted or estimated with rational methods. Future cost estimate is useful for decision making because decision are meant for future.

6. Traceable and common costs:

Traceable costs otherwise called direct cost, is one, which can be identified with a products process or product. Raw material, labour involved in production is examples of traceable cost.

Common costs are the ones that common are attributed to a particular process or product. They are incurred collectively for different processes or different types of products. It cannot be directly identified with any particular process or type of product.

7.Avoidable and unavoidable cost:

Avoidable costs are the costs, which can be reduced if the business activities of a concern are curtailed. For example, if some workers can be retrenched with a drop in a product – line, or volume or production the wages of the retrenched workers are escapable costs.

The unavoidable costs are otherwise called sunk costs. There will not be any reduction in this cost even if reduction in business activity is made. For example cost of the ideal machine capacity is unavoidable cost.

8. Controllable and uncontrollable costs:

Controllable costs are ones, which can be regulated by the executive who is in change of it. The concept of controllability of cost varies with levels of management. Direct expenses like material, labour etc. are controllable costs.

Some costs are not directly identifiable with a process of product. They are appointed to various processes or products in some proportion. This cost varies with the variation in the basis of allocation and is independent of the actions of the executive of that department. These apportioned costs are called uncontrollable costs.

BREAKEVEN ANALYSIS

The study of cost-volume-profit relationship is often referred as BEA. The term BEA is interpreted in two senses. In its narrow sense, it is concerned with finding out BEP; BEP is the point at which total revenue is equal to total cost. It is the point of no profit, no loss.

Assumptions:

1. All costs are classified into two – fixed and variable.
2. Fixed costs remain constant at all levels of output.
3. Variable costs vary proportionally with the volume of output.
4. Selling price per unit remains constant in spite of competition or change in the volume of production.
5. There will be no change in operating efficiency.

Break Even Point

An analysis to determine the point at which revenue received equals the costs associated with receiving the revenue. Break-even analysis calculates what is known as a margin of safety,

The amount that revenues exceed the break-even point. This is the amount that revenues can fall while still staying above the break-even point.
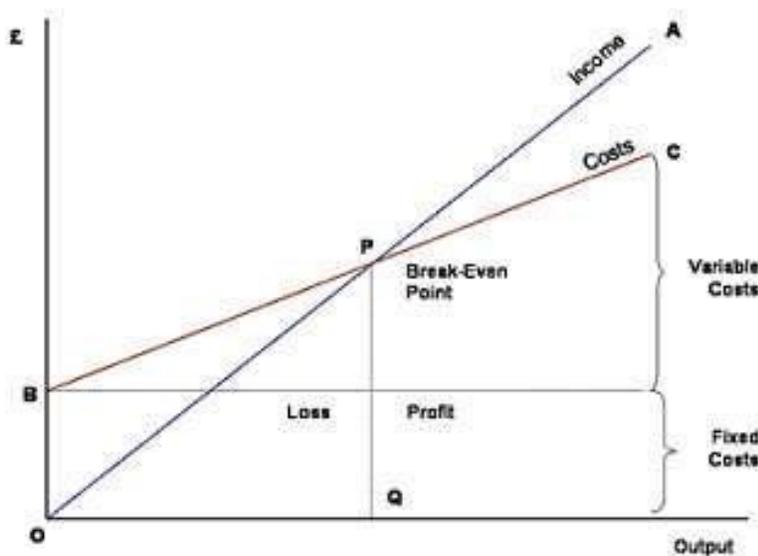
Merits:

1. Break Even Chart discloses the relationship between cost, volume and profit. It reveals how changes in profit. So, it helps management in decision-making.
2. It is very useful for forecasting costs and profits long term planning and growth
3. The chart discloses profits at various levels of production.
4. It serves as a useful tool for cost control.
5. It can also be used to study the comparative plant efficiencies of the industry.
6. Analytical Break-even chart present the different elements, in the costs – direct material, direct labour, fixed and variable overheads.

Demerits:

1. Break-even chart presents only cost volume profits. It ignores other considerations such as capital amount, marketing aspects and effect of government policy etc., which are necessary in decision making.
2. It is assumed that sales, total cost and fixed cost can be represented as straight lines. In actual practice, this may not be so.
3. It assumes that profit is a function of output. This is not always true. The firm may increase the profit without increasing its output.
4. A major draw back of BEC is its inability to handle production and sale of multiple products.

5. It is difficult to handle selling costs such as advertisement and sale promotion in BEC.

Various variables used in BEP, they are:-

1. Fixed cost
2. Variable cost
3. Contribution
4. Margin of safety
5. Profit volume ratio
6. Break-Even-Point

1. **Fixed cost:** Expenses that do not vary with the volume of production are known as fixed expenses. Eg. Manager's salary, rent and taxes, insurance etc. It should be noted that fixed changes are fixed only within a certain range of plant capacity.

2.Variable Cost: Expenses that vary almost in direct proportion to the volume of production of sales are called variable expenses. Eg. Electric power and fuel, packing materials consumable stores. It should be noted that variable cost per unit is fixed

3.**Contribution:** Contribution is the difference between sales and variable costs and it contributed towards fixed costs and profit. It helps in sales and pricing policies and measuring the profitability of different proposals. Contribution is a sure test to decide whether a product is worthwhile to be continued among different products.

Contribution = Sales – Variable cost

Contribution = Fixed Cost + Profit.

4.**Margin of safety:** Margin of safety is the excess of sales over the break even sales. It can be expressed in absolute sales amount or in percentage. It indicates the extent to which the sales can be reduced without resulting in loss. A large margin of safety indicates the soundness of the business. The formula for the margin of safety is:

$$\text{Present sales – Break even sales} \quad \textbf{or} \quad \frac{\text{Profit}}{\text{P. V. ratio}}$$

Margin of safety can be improved by taking the following steps.

1. Increasing production
2. Increasing selling price

5.Profit Volume Ratio is usually called P. V. ratio. It is one of the most useful ratios for studying the profitability of business. The ratio of contribution to sales is the P/V ratio. It may be expressed in percentage. The concept of P. V. ratio helps in determining break even-point, a desired amount of profit etc.

$$\text{The formula is,} \quad \frac{\text{Contribution}}{Sales} \times 100$$

6.**Break – Even- Point:** If we divide the term into three words, then it does not require further explanation.

Break Even Point refers to the point where total cost is equal to total revenue. It is a point of no profit, no loss. This is also a minimum point of no profit, no loss. This is also a minimum point of production where total costs are recovered. If sales go up beyond the Break Even Point, organization makes a profit. If they come down, a loss is incurred.

1. Break Even point (Units) = $\dfrac{\text{Fixed Expenses}}{\text{Contribution per unit}}$

2. Break Even point (In Rupees) = $\dfrac{\text{Fixed expenses}}{\text{Contribution}} \times \text{sales}$

Significance of BEP

Breakeven point analysis is a very important tool, especially if you are preparing a business plan, to figure out the volume of sales your arts and crafts business needs to make in order to cover both your variable and fixed costs. At breakeven point, your arts and crafts business has made or lost no money.

Important info for you as the business owner is you have to be able to hand craft your arts and crafts items at a price that your customers will pay while still providing an adequate amount of income to cover your personal living expenses. Once you get the hang of it you will find it quick and easy to figure breakeven point using an Excel spreadsheet.