

## **Sem-I; Unit-III**

### **Module -3: Theory of Production**

Concept and Objectives of Firm - Production Function: Cobb- Douglas Production Function

-Law of Variable Proportions -Laws of Returns to Scale - Concepts of Cost - Total, Average

And Marginal Costs - Law of Supply - Concept of Revenue: Total, Average and Marginal

Revenues.

#### **1. Define firm? Explain the objectives of firm?**

**A: Definition of Firm:** Firm is a business organization that buys or hires factors of production to produce goods and services that can be sold at a profit.

#### **Objective of firm:**

1. Profit Maximization
2. Sales Maximization
3. Output Maximization
4. Security Profits
5. Satisfaction Maximization.
6. Utility Maximization
7. Growth Maximization.

**1. Profit Maximization:** In the conventional theory of the firm, the principal objective of a business firm is profit maximization. Under the assumptions of given tastes and technology, price and output of a given product under perfect competition are determined with the sole objective of maximizing profits. The firm is supposed to act as one of many producers which cannot influence the market price of the product.

**2. Sales Maximization:** Firms often seek to increase their market share even if it means less profit. This could occur for various reasons: Increased market share increases monopoly power and may enable the firm to put up prices and make more profit in the long run. Managers prefer to work for bigger companies as it leads to greater prestige and higher salaries.

**3. Output Maximization:** Output maximization should be objective of business firm. However, output maximization without sales maximization will not enable a firm to survive for long time.

**4. Security Profits:** Security profits are very relevant, particularly under oligopoly where a firm is engaged in constant struggle to achieve and secure position in the market.

**5. Satisfaction Maximization:** Satisfactory profits are targeted on the basis of its profit expectations, which are shaped in accordance with the prevailing environment and circumstances.

**6. Utility Maximization:** It aims at maximization of managerial utility in terms of leisure, better salaries, security, prestige and comforts of managers, the strength of the staff employed, health etc.

**7. Growth Maximization:** This is like sales maximization and may involve mergers and takeovers. With this objective, the firm may be willing to make lower levels of profit to increase in size and gain more market share. More market share increases its monopoly power and ability to be a price setter.

## **2. What is productionfunction?**

**A:** In economics, “The production function is a technical relation between input and output. Production is the result of co-operation of four factors of production viz., land, labour, capital, and organization.

Mathematically, such a basic relationship between inputs and outputs may be expressed as:

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

Where Q = Quantity of output

F= functional relationship

N = Land.

L = Labour

C = Capital

O= Organization.

## **3. Explain the Cobb- Douglas Production Function?**

**A: Cobb- Douglas Production Function:** The Cobb–Douglas production function is a particular functional form of the production function, widely used to represent the technological relationship between the amounts of two or more inputs (particularly physical capital and labor) and the amount of output that can be produced by those inputs. The Cobb–Douglas form was developed and tested against statistical evidence by Charles Cobb and Paul Douglas.

The Cobb-Douglas Production Function, given by Charles W. Cobb and Paul H. Douglas is a linear homogeneous production function, which implies, that the factors of production can be substituted for one another up to a certain extent only.

With the proportionate increase in the input factors, the output also increases in the same proportion. Thus, there are constant returns to a scale. In Cobb-Douglas production function,

only two input factors, labor, and capital are taken into the consideration, and the elasticity of substitution is equal to one. It is also assumed that, if any, of the inputs, is zero, the output is also zero.

Likewise, in the linear homogeneous production function, the expansion path generated by the Cobb-Douglas function is also a straight line passing through the origin. The Cobb-Douglas function can be expressed as follows:

$$Q = AL^\alpha K^\beta$$

Where, Q = output

A = positive constant

K = capital employed

L = Labor employed

$\alpha$  and  $\beta$  = positive fractions show the elasticity coefficients of outputs for inputs labor and capital, respectively.

This algebraic form of Cobb-Douglas function can be changed in a log linear form, with the help of regression analysis:

$$\log Q = \log A + \alpha \log L + \beta \log K$$

The homogeneity of the Cobb-Douglas production function can be checked by adding the values of  $\alpha$  and  $\beta$ . If the sum of these parameters is equal to one, then it shows that the production function is linearly homogeneous, and there are constant returns to a scale. If the sum of these parameters is less or more than one, then there is a decreasing and increasing returns to a scale, respectively.

#### **4. Explain the Law of Variable Proportions with diagram (Law of diminishing returns)?**

A: Law of Variable Proportions occupies an important place in economic theory. The law of variable proportions states that as the quantity of one factor is increased, keeping the other factors fixed; the marginal product of that factor will eventually decline. This means that up to the use of a certain amount of variable factor, marginal product of the factor may increase and after a certain stage it starts diminishing. Keeping other factors fixed, the law explains the production function with one factor variable. In the short run when output of a commodity is sought to be increased, the law of variable proportions comes into operation.

Therefore, when the number of one factor is increased or decreased, while other factors are constant, the proportion between the factors is altered. For instance, there are two factors of production viz., land and labour.

**Assumptions:** Law of variable proportions is based on following assumptions:

**1. Constant Technology:** The state of technology is assumed to be given and constant. If there is an improvement in technology the production function will move upward.

**2. Factor Proportions are Variable:** The law assumes that factor proportions are variable. If factors of production are to be combined in a fixed proportion, the law has no validity.

**3. Homogeneous Factor Units:** The units of variable factor are homogeneous. Each unit is identical in quality and amount with every other unit.

**4. Short-Run:** The law operates in the short-run when it is not possible to vary all factor inputs.

**Explanation of the Law:** To understand the law of variable proportions we take the example of agriculture. Suppose land and labour are the only two factors of production. By keeping land as a fixed factor, the production of variable factor i.e., labour can be shown with the help of the following table:

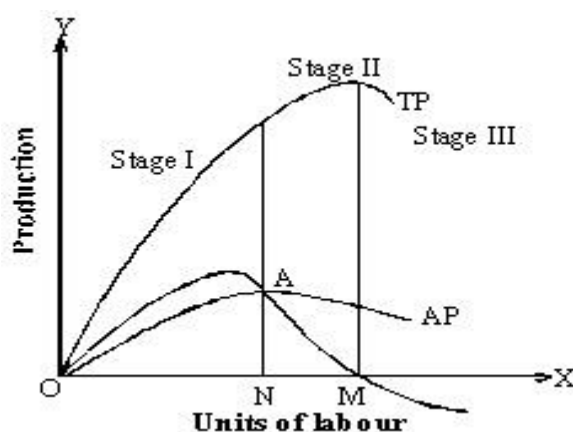
| Labour (Q) | TP | AP  | MP | Stages    |
|------------|----|-----|----|-----------|
| 1          | 3  | 3   | 3  | Stage-I   |
| 2          | 7  | 3.5 | 4  |           |
| 3          | 12 | 4   | 5  |           |
| 4          | 16 | 4   | 4  | Stage-II  |
| 5          | 19 | 3.8 | 3  |           |
| 6          | 21 | 3.5 | 2  |           |
| 7          | 22 | 3.1 | 1  |           |
| 8          | 22 | 2.8 | 0  |           |
| 9          | 21 | 2.3 | -1 | Stage-III |
| 10         | 19 | 1.9 | -2 |           |

From the above table there are three stages of the law of variable proportion. In the first stage average production increases as there are more and more doses of labour and capital employed with fixed factors (land). We see that total product, average product, and marginal product increases but average product and marginal product increases up to 3 units. Later on, both start decreasing because proportion of workers to land was sufficient and land is not properly used. This is the end of the first stage.

The second stage starts from where the first stage ends or where  $AP=MP$ . In this stage, average product and marginal product start falling. We should note that marginal product falls at a faster rate than the average product. Here, total product increases at a diminishing rate. It is also maximum at 8 units of labour where marginal product becomes zero while average product is never zero or negative.

The third stage begins where second stage ends. This starts from 9th unit. Here, marginal product is negative and total product falls, but average product is still positive. At this stage, any additional dose leads to positive nuisance because additional dose leads to negative marginal product.

**Graphic Presentation:** The information of three stages which was explained in above table can be shown in below diagram.



In above diagram on OX axis, we have measured number of labourers while quantity of product is shown on OY axis. TP is total product curve. Up to point 'N', total product is increasing at increasing rate. Between points 'N' and 'M' it is increasing at the decreasing rate. Here marginal product has started falling. At point 'M' i.e., when 8 units of labourers are employed, total product is maximum while, marginal product is zero. Thereafter, it begins to diminish corresponding to negative marginal product. In the lower part of the figure MP is marginal product curve.

Up to point 'N' marginal product increases. At point 'N', i.e., when 3 units of labourers are employed, it is maximum. After that, marginal product begins to decrease. Before point 'M' marginal product becomes zero and it turns negative. AP curve represents average product. Before point 'N', average product is less than marginal product. At point 'N' average product is maximum after that it starts to diminish.

## 5. Explain the Laws of Returns to Scale?

A: In the long run all factors of production are variable. No factor is fixed. Accordingly, the scale of production can be changed by changing the quantity of all factors of production. The term returns to scale refers to the changes in output as all factors change by the same proportion. Returns to scale relates to the behaviour of total output as all inputs are varied and is a long run concept.

**Explanation:** In the long run, output can be increased by increasing all factors in the same proportion. Generally, laws of returns to scale refer to an increase in output due to increase in all factors in the same proportion. Such an increase is called returns to scale.

**Assumptions:** Laws of Returns to Scale are based on the following assumptions.

1. All the factors of production are variable but organization is fixed.
2. There is no change in technology.
3. There is perfect competition in the market.
4. Outputs or returns are measured in physical quantities.

**Three Phases of Returns to Scale:** Returns to scale are of the following three types:

1. Increasing Returns to scale.
2. Constant Returns to Scale
3. Diminishing Returns to Scale

**1. Increasing Returns to Scale:** In this case if all inputs are increased by one per cent, output increase by more than one per cent.

**2. Constant Returns to Scale:** In this case if all inputs are increased by one per cent, output increases exactly by one per cent.

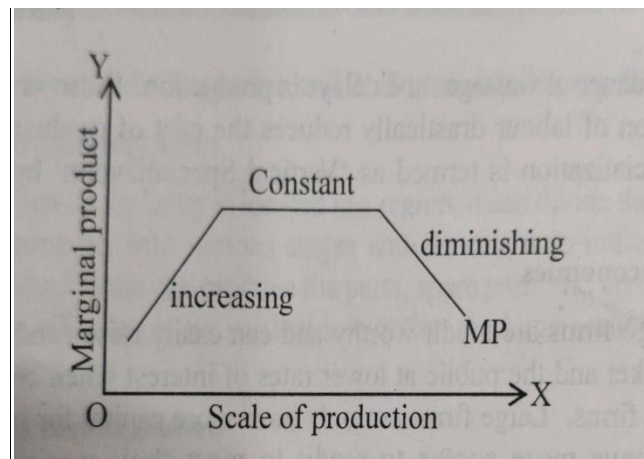
**3. Diminishing Returns to Scale:** In this case if all inputs are increased by one per cent, output increases by less than one per cent.

These three stages of returns to scale can be explained with the help of below table.

**Table:**

| Q | TP | MP | Returns to Scale    |
|---|----|----|---------------------|
| 1 | 4  | 4  | Increasing Returns  |
| 2 | 9  | 5  |                     |
| 3 | 15 | 6  | Constant Returns    |
| 4 | 21 | 6  |                     |
| 5 | 26 | 5  | Diminishing Returns |
| 6 | 30 | 4  |                     |

**Diagrammatic Illustration:** The three laws of returns to scale can be explained with the help of the diagram below.



When all the inputs are increased, returns can be increasing, constant and diminishing. Returns to scale said to be increasing when a proportionate increase in all the inputs results in a more than proportionate increase in output. Returns to scale are said to be constant when a proportionate increase in all inputs results in same proportionate increase in output. Returns to scale are said to be diminishing when a proportionate increase in all the inputs results in a less than proportionate increase in output. In above diagram the three types of returns to scale are explained.

## 6. What is cost? Explain the Concepts of various Costs?

A: In Economics cost means cost of production. It refers to the total cost incurred by a business to produce a specific quantity of a product. Production costs may include things such as labour, raw materials. In economics, the cost of production is defined as the expenditures incurred to obtain the factors of production such as labour, land, and capital that are needed in the production process of a product.

**Types of Costs of Production:** There are various types of costs of production that businesses may incur while manufacturing a product. They include the following:

**1. Fixed costs (FC):** Fixed costs are expenses that do not change with the amount of output produced. This means that the costs remain unchanged even when there is zero production or when the business has reached its maximum production capacity. For example, a restaurant business must pay its monthly, quarterly, or yearly rent regardless of the number of customers it serves. Other examples of fixed costs include salaries and equipment leases. Fixed costs tend to be time-limited, and they are only fixed in relation to the production for a certain period.

**2. Variable costs (VC):** Variable costs are costs that change with the changes in the level of production. That is, they rise as the production volume increases and decrease as the production volume decreases. If the production volume is zero, then no variable costs are incurred. Examples of variable costs include sales commissions, utility costs, raw materials, and direct labour costs.

**3. Total cost (TC):** Total cost encompasses both variable and fixed costs. It takes into account all the costs incurred in the production process or when offering a service.

**Total Costs (TC) = Fixed (FC) + Variable Cost (VC).**

**4. Average cost (AC):** The average cost refers to the total cost of production divided by the number of units produced. It can also be obtained by summing the average variable costs and the average fixed costs. Management uses average costs to make decisions pricing its products for maximum revenue or profit. The goal of the company should be to minimize the average cost per unit so that it can increase the profit margin without increasing costs.

**5. Marginal cost (MC):** Marginal cost is the cost of producing one additional unit of output. It shows the increase in total cost coming from the production of one more product unit. Since fixed costs remain constant regardless of any increase in output, marginal cost is mainly affected by changes in variable costs. If the total cost of 3 units is 1500, and the total cost of 4 units is 1900. The marginal cost of the 4th unit is 400( $1900-1500=400$ ).

**7. Explain the Law of Supply?**

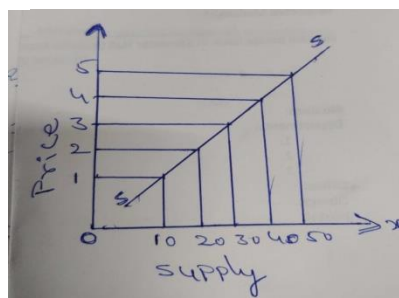


**A:** The law of supply is a fundamental principle of economic theory which states that, keeping other factors constant, an increase in price results in an increase in quantity supplied. In other words, there is a direct relationship between price and quantity, quantities respond in the same direction as price changes. The law of supply states that other factors being equal, the quantity of a good, supplied increases with an increase in the price level and decreases with a decrease in price level of a good.

**Supply schedule:** A supply schedule is a table that shows the relationship between the price of a good and the quantity supplied. Supply schedule below shows the positive relationship between price and quantity supplied.

| Price (P) (in Rs.) | Supply (S) (in No) |
|--------------------|--------------------|
| 1                  | 10                 |
| 2                  | 20                 |
| 3                  | 30                 |
| 4                  | 40                 |
| 5                  | 50                 |

**Supply Curve:** The supply curve is a graphic representation of the correlation between the cost of a good and the quantity supplied for a given period. In a typical illustration, the price will appear on the vertical axis, while the quantity supplied will appear on the horizontal axis.



## 8. Define the concept of Revenue? Explain the various concepts of Revenues?

**A:** The term revenue refers to the income obtained by a firm through the sale of goods at different price.

**Types of Revenue:** The revenue concepts are concerned with Total Revenue, Average Revenue and Marginal Revenue.

**1. Total Revenue (TR):** Total revenue is the sum of all sales, receipts or income of a firm. Total Revenue refers to total receipts from the sale of a given quantity of a commodity. It is the total income of a firm. Total revenue is obtained by multiplying the quantity of the commodity sold with the price of the commodity. Total Revenue= Price x Quantity.

$$TR = P \times Q$$

TR-Total Revenue

P=Price

Q=Quantity or output

**2. Average Revenue (AR):** Average revenue refers to the revenue obtained by the seller by selling the per unit commodity. Average revenue refers to revenue per unit of output sold. It is obtained by dividing the total revenue by the number of units sold.

$$\text{Average Revenue} = \text{Total Revenue} / \text{Quantity}$$

$$AR = TR / Q$$

AR= Average Revenue

TR-Total Revenue

Q=Quantity or output

**3. Marginal Revenue:** Marginal revenue is the additional revenue generated from the sale of an additional unit of output. It is the change in Total Revenue from sale of one more unit of a commodity.

$$MR_n = TR_n - TR_{n-1}$$

$MR_n$  = Marginal revenue of nth unit.

$TR_n$  = Total revenue from n units.

$TR_{n-1}$  = Total revenue from (n – 1) units; n = number of units sold