



## Chapter – 3

# Theory of Production and Cost

## Unit - 1 Theory of Production

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### ■ **Meaning of Production**

- Generally, production refers to the process of converting inputs into output.
- According to James Bates and J.R. Parkinson “Production is the organized activity of transforming resources into finished products in the form of goods and services; and the objective of production is to satisfy the demand of such transformed resources”.

### ■ **Production does not include**

- Work done within household by anyone out of love and affection
- **Example :** Food Cooked by Mom is not production

### ■ **Production confer following types of utilities**

- (1) Place utility → Apple from Kashmir
- (2) Time utility → Safal Matar
- (3) Form utility → (Input → Output)
- (4) Personal utility → Services of CA

### ■ **Factors of Production**

- (1) Land
- (2) Labour
- (3) Capital
- (4) Entrepreneur

### ■ **Land includes**

- (1) Natural resources
- (2) Soil
- (3) Water
- (4) Air and Light



### ■ **Characteristics of Land**

- (i) Land is a free gift of nature:
- (ii) Land is permanent and has indestructible power:
- (iii) Land is a passive factor:
- (iv) Land is immobile:
- (v) Land has multiple uses:
- (vi) Land is heterogeneous:

**NOTE - Supply of Land is perfectly inelastic from overall economy's point of view Land is relatively elastic from the point of view of a firm.**

### ■ **Characteristics of labour**

- (1) Human Effort:
- (2) Labour is perishable:
- (3) Labour is an active factor:
- (4) Labour is inseparable from the labour:
- (5) Labour power differs from labourer to labourer:
- (6) All labour may not be productive:
- (7) Labour has poor bargaining power:
- (8) Labour is mobile:
- (9) Choice between hours of labour and hours of leisure:
- (10) There is no rapid adjustment of supply of labour to the demand for it

**Note :** Labour supply curve is backward bending

### ■ **Capital**

- Capital is a part of the wealth that is used for the purpose of producing more wealth.
- Capital is a stock concept, representing accumulated resources, while income generated from capital is a flow concept.

### ■ **Types of Capital**

- (a) Fixed capital is durable nature capital. For example tools, machines, etc.
- (b) Circulating capital is a single use capital and is not available for further use. For example, seeds, fuel, raw materials, etc.



- (c) Real (tangible) capital refers to physical goods such as building, plant, machines, etc.
- (d) Human capital refers to human skill and ability.
- (e) Tangible capital can be perceived by senses whereas intangible capital is in the form of certain rights and benefits which cannot be perceived by senses. For example, copyrights, goodwill, patent rights, etc.
- (f) Individual capital is personal property.
- (g) Social Capital is what belongs to the society as a whole in the form of roads, bridges, etc.

## ■ **Capital Formation**

- Capital formation refers to the process of increasing the stock of real capital in a country.
- It involves the production of capital goods such as machines, tools, factories, transportation equipment, and electricity, which are used for further production of goods.
- Capital formation is also known as investment.

## ■ **Stages of capital formation**

There are mainly three stages of capital formation which are as follows:

- (a) Savings
- (b) Mobilization of Savings
- (c) Investment:

## ■ **Entrepreneur**

- The entrepreneur is the fourth factor of production, distinct from land, capital, and labor.
- The entrepreneur mobilizes the other factors, combines them in the right proportions, and initiates the production process.
- The entrepreneur is responsible for bearing the risks associated with the production process.

## ■ **Function of Entrepreneur**

- (1) Initiating business enterprise and resource co-ordination
- (2) Risk bearing or uncertainty bearing Financial risks & Technological risks, Profit is reward, risk bearing cannot be delegated
- (3) Innovations – **Most Important Function**

## ■ **Enterprise's Objectives**

- (1) Organic objectives
- (2) Economic objectives
- (3) Social objectives
- (4) Human objectives



(5) National objectives

### ■ **Constraints of an enterprise in achievement of its Objectives**

In the pursuit of the above objectives an enterprise's action may get constrained in following ways-

- (i) Lack of knowledge and information about many variable the affect business.
- (ii) Constraints may be experienced due to governments' restrictions on the production, price and movement of factors.
- (iii) There may be infrastructural bottleneck.
- (iv) Changes in business and economic conditions; change in government policies about location, prices, taxes, etc.; natural calamities like fire, flood, famine, etc.
- (v) Constraints are also faced due to inflation, rising interest rates, unfavourable exchange rate, capital and labour costs, etc.

### ■ **Enterprise's Problems**

- (1) Problems relating to objectives:
- (2) Problems relating to location and size of the plant
- (3) Problems relating to selecting and organising physical facilities:
- (4) Problems relating to Finance:
- (5) Problems relating to organisation structure:
- (6) Problems relating to marketing:
- (7) Problems relating to legal formalities:
- (8) Problems relating to industrial relations:

### ■ **Production Function**

- The production function is a statement of the relationship between a firm's scarce resources (i.e. its inputs) and the output that results from the use of these resources.
- It states technological relationship between inputs and output.

### ■ **Assumptions of Production Function:**

There are three main assumptions:

- (a) the relationship between inputs and outputs exists for a specific period of time.
- (b) there are no significant changes in the state of technology during the given period of time.
- (c) The output achieved by utilizing any combination of inputs in a specific function is maximized.

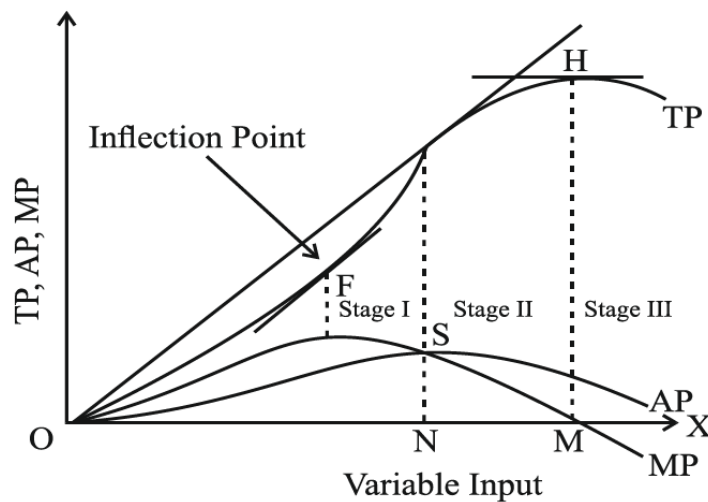
### ■ **Short Run Production Function**

- A period will be considered short-run period if at least one of the inputs used remains unchanged during that period.



- Short-run production function shows the maximum amount of a good or service that can be produced by a set of inputs, assuming that the amount of at least one of the inputs used remains fixed (or unchanged).
- In the short-run, the production function is studied by holding the quantities of capital fixed, while varying the amount of other factors (labour, raw material etc.) This is done when the law of variable proportion is studied.

<b>Total Product</b>	<ul style="list-style-type: none"> <li>❑ The total output produced by all the factors per unit of time is called total product.</li> <li>❑ Total product increases with an increase in the variable factor input.</li> </ul>
<b>Average Product</b>	<ul style="list-style-type: none"> <li>❑ The average product means the total product per unit of a variable factor.</li> <li>❑ In order words, it is the total product divided by the number of units of a variable factor.</li> </ul> $\text{Average Product} = \frac{\text{Total Product}}{\text{No of units of variable factor}}$ <p style="text-align: center;">OR</p> $\text{AP} = \frac{\text{TP}}{\text{L}}$
<b>Marginal Product</b>	<ul style="list-style-type: none"> <li>❑ The marginal product means addition made to total product by the use of an extra unit of variable factor.</li> <li>❑ It may be stated as = <math>\text{MP}_n = \text{TP}_n - \text{TP}_{n-1}</math></li> <li>❑ Marginal Product may also be defined as the change in total output due to use of additional unit of variable factor</li> </ul> $\text{MP} = \frac{\Delta \text{TP}}{\Delta \text{L}}$





### ■ Three Stages of Production under Short run production Function

STAGE	TP	MP	AP
Stage I	Increases at an increasing rate	Increases and reaches at maximum point.	Increases and reaches its maximum point.
Stage II	Increases at diminishing rate and reaches its maximum point	Decreases and becomes zero	After reaching its maximum point begins to decrease
Stage III	Begins to fall.	Becomes Negative	Continues to diminish

#### NOTE –

1. the rational choice for a producer is to operate in Phase II, where the total product (TP) is at its maximum and the marginal product of each variable factor remains positive. Operating in Phase II allows the producer to maximize output and maintain a favorable production level for optimal profitability.
2. Phase 1 and 3 are the stages of absurdity/non-sense

### ■ Relationship Between AP & MP

The relationship between average product and marginal product can be summed up as follows:

1. When average product rises as a result of an increase in the quantity of variable input, marginal product is more than the average product.
2. When average product is maximum, marginal product is equal to average product. In other words, the marginal product curve cuts the average product curve at its maximum.
3. When average product falls, marginal product is less than the average product.

### ■ Long Run Production Function

- The long run is a period of time (or planning horizon) in which all factors of production are variable.
- It is a time period when the firm will be able to install new machines and capital equipment's apart from increasing the variable factors of production.
- A long-run production function shows the maximum quantity of a good or service that can be produced by a set of inputs, assuming that the firm is free to vary the amount of all the inputs being used.

The behaviour of production when all factors are varied is the subject matter of the law of returns to scale.

### ■ Returns to Scale



- The Law of Returns to Scale examines the production function i.e., the input – output relation in long run where increase in output can be achieved by varying the units of ALL FACTORS IN THE SAME PROPORTION.
- Thus, in long run all factors becomes variable.
- It means that in long run the scale of production and the size of the firm can be increased.
- The law of returns to scale analyse the effects of scale on the level of output as

<b>1. Increasing Returns to Scale</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> When the output increases by a greater proportion than the proportion increases in all the factor inputs, it is increasing returns to scale.</li><li><input type="checkbox"/> E.g., When all inputs are increased by 10% and output rises by 30%.</li><li><input type="checkbox"/> The reasons of increasing returns to scale are – internal and external economies of scale; indivisibility of fixed factors; improved organisation; division of labour and specialisation; better supervision</li><li><input type="checkbox"/> and control; adequate supply of productive factors, etc.</li></ul>
<b>2. Constant Returns to Scale</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> When the output increases exactly in the same proportion as that of increases in all factor inputs, it is constant returns to scale.</li><li><input type="checkbox"/> E.g., - When all inputs are increased by 10% and output also rises by 10%.</li></ul>
<b>3. Diminishing Returns to Scale</b>	<ul style="list-style-type: none"><li><input type="checkbox"/> When the output increases by a lesser proportion that the proportion increase in all the factor inputs, it is diminishing returns to scale.</li><li><input type="checkbox"/> E.g. When all inputs are increased by 20% but output rises by 10%.</li><li><input type="checkbox"/> The reason of diminishing returns to scale is increased internal and external diseconomies of production.</li></ul>

### ■ **Cobb-Douglas Production Function**

- A famous statistical production function is Cobb-Douglas production function.
- Paul H. Douglas and C.W. Cobb of the U.S.A. studied the production function of the American manufacturing industries.
- In its original form, this production function applies not to an individual firm but to the whole of manufacturing in the United States.
- In this case, output is manufacturing production and inputs used are labour and capital
- Cobb-Douglas production function is stated as:

$$Q = KL^aC^{(1-a)}$$

where 'Q' is output, 'L' the quantity of labour and 'C' the quantity of capital. 'K' and 'a' are positive constants.

- The conclusion drawn from this famous statistical study is that labour contributed about 3/4th and capital about 1/4th of the increase in the manufacturing production.

### ■ **Understanding Returns to Scale through Cobb-Douglas Production Function**



The Cobb-Douglas production function, explained earlier is used to explain “returns to scale” in production. Originally, Cobb and Douglas assumed that returns to scale are constant. The function was constructed in such a way that the exponents summed to  $a + 1 - a = 1$ . However, latter they relaxed the requirement and rewrote the equation as follows:

$$Q = K L^a C^b$$

- If  $a + b > 1$  Increasing returns to scale result i.e. increase in output is more than the proportionate increase in the use of factors (labour and capital).
- If  $a + b = 1$  Constant returns to scale result i.e. the output increases in the same proportion in which factors are increased.
- If  $a + b < 1$  decreasing returns to scale result i.e., the output increases less than the proportionate increase in the labour and capital.

**Isoquants:** Equal-production curves, production indifference curves or iso-product curves.

An isoquant represents all those combinations of inputs which can produce the same level of output.

### ■ Properties of Isoquants

- (1) Negatively sloped,
  - (2) Convex to the origin due to diminishing MRTS
  - (3) Curve on right represents a higher level of output
  - (4) Non intersecting.
- Isocost line – Equal-Cost Line or budget line or budget constraint line,
  - It shows various alternative combinations of two factors which the firm can buy with given outlay.
  - Whatever be the combination of factors the firm chooses on isocost line, the total cost to firm remains the same.

(Slope of Isoquant = MRTS)

A producer can produce the desired output at least possible cost at equilibrium.

Producer equilibrium will be achieved where isocost line is TANGENT to isoquant (at point C)

