



# Chapter Four

## Theory of Production and Cost

# Introduction

Whatever be the objective of business firms, achieving optimum efficiency in production or minimizing the cost of production is one of the prime concerns of managers today. Infact, the very survival of the firms in a competitive market depend on their ability to produce at a competitive cost.

## ***Production:***

Production means transforming inputs ( Labor, Machines, Raw materials etc.) into an output.

# ***Some Basic Concepts***

## ***Input and Output:***

- An input is a good or service that goes into the process of production.
- 1. Land: (**rent.**)  
refers to both the surface of the earth and all the natural gifts carried by land and usable in the production of goods and services. ,
- 2. Labor, (**wage.**)  
all physical and mental talents of people in production and distribution of goods and services
- 3. Capital,( **interest.**)  
all *man-made* resources and all the wealth with the exception of land
- 4. Entrepreneur .
  - - refers to a special type of human talent that helps organize and manage factors of production to produce goods and services with associated risk of losses.
  - ***The act of employing ones mental talent for own business .***

**An output :** is any good or service that comes out of the production process.

## ***Fixed Inputs & Variable Inputs:***

- Fixed inputs remains fixed (constant) up to certain level of output.
- Variable inputs change with the change in output.

## ***Short Run and Long Run:***

- Short run refers to a period of time in which supply of certain inputs i.e., plant, building and machinery etc. is fixed or inelastic.
- Long run refers to a time period in which the supply of all the inputs is elastic or variable.

# Short Production Function

- Production function is defined as “***the functional relationship between physical inputs ( i.e., factors of production ) and physical outputs, i.e., the quantity of goods produced***”.
- Production function may be expressed as under:

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

Where ;

**Q** = Output of commodity per unit of time.

**K** = Capital.

**L** = Labour.

**f** = Functional Relationship.

## Total, Average, Marginal Products and the Law of Diminishing Returns

### 1. Total product (TP):

- is the over all amount of output produced by the factors of production employed over a given period

### 2. Average product (AP):

- output ratio for each level of input and the corresponding level of output).
- $AP = TP/L$ ;
- is a good indicator of the *productivity* of labor

### **3. Marginal Product (MP):**

- it is the increase in output which results from using one additional or extra unit of a single factor input, holding the quantities of other factors constant
- $MP = \Delta TP / \Delta L$

### **4. The law of diminishing returns**

- increasing the amount of the variable factor (labor) with fixed factor (capital) will lead to an eventual decline in the marginal contribution of the additional labor to the total output
- Is short run phenomenon

# Stages of production

## 1. Stage one :

- it is a range of increasing average physical product
- Ranges from the origin up to the equality of AP and MP
- the TP increases at an increasing rate
- Law of diminishing return to scale operates in this stage
- is excess capital for the very limited variable input (labor).
- is known as *extensive margin*
- labor is underemployed and capital is underutilized.

## 2. Stage II:

- stage production ranges from maximum of  $AP_L$  to zero  $MP_L$ .
- TP reaches its maximum level at this stage
- APL is more than the MPL curve.

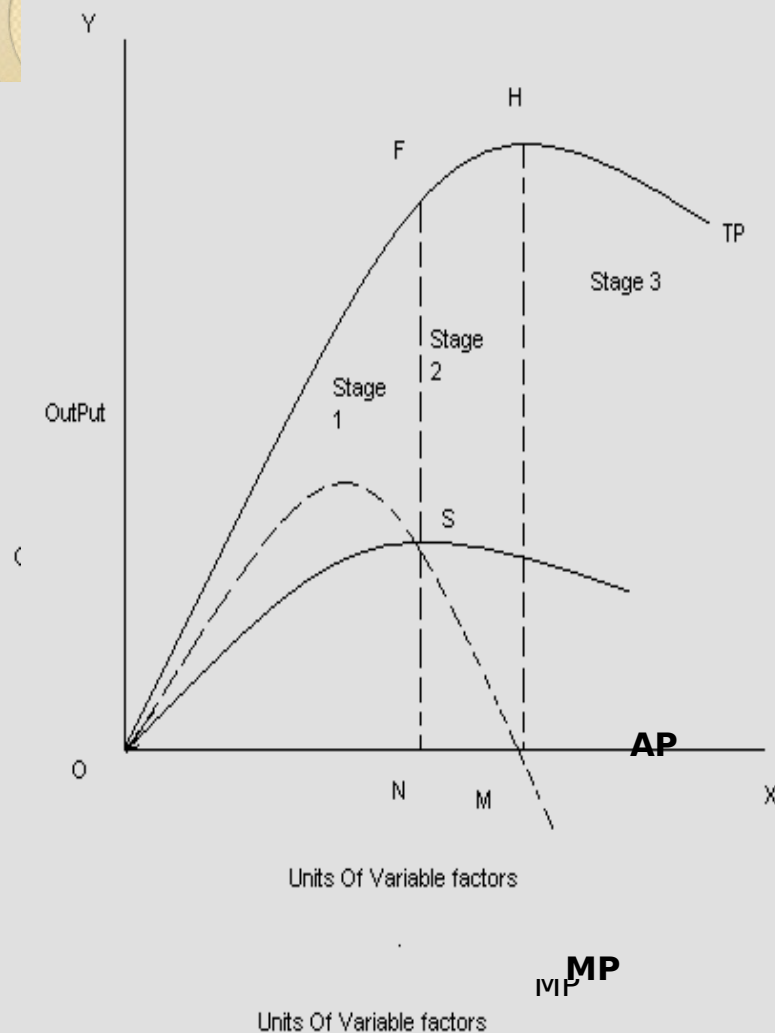
## 3. Stage three:

- it is the stage of production where the marginal contribution of any additional labor becomes negative or
- it is the level of production where the TP starts to decline with one more labor employed
- labor is **over employed** and capital is **over utilized**.
- This stage of production is known as *intensive margin*.

# Tabular Presentation of Law of Variable Proportions

| <b>Fixed input</b> | <b>Variable input Labour</b> | <b>TP</b>  | <b>AP</b>   | <b>MP</b>  |                  |
|--------------------|------------------------------|------------|-------------|------------|------------------|
| <b>1 hect ar</b>   | <b>0</b>                     | <b>0</b>   | <b>-</b>    | <b>-</b>   | <b>I Stage</b>   |
| <b>"</b>           | <b>1</b>                     | <b>10</b>  | <b>10</b>   | <b>10</b>  |                  |
| <b>"</b>           | <b>2</b>                     | <b>28</b>  | <b>14</b>   | <b>18</b>  | <b>II Stage</b>  |
| <b>"</b>           | <b>3</b>                     | <b>51</b>  | <b>17</b>   | <b>23</b>  |                  |
| <b>"</b>           | <b>4</b>                     | <b>76</b>  | <b>19</b>   | <b>25</b>  |                  |
| <b>"</b>           | <b>5</b>                     | <b>95</b>  | <b>19</b>   | <b>19</b>  | <b>III Stage</b> |
| <b>"</b>           | <b>6</b>                     | <b>108</b> | <b>18</b>   | <b>13</b>  |                  |
| <b>"</b>           | <b>7</b>                     | <b>108</b> | <b>15.4</b> | <b>0</b>   |                  |
| <b>"</b>           | <b>8</b>                     | <b>96</b>  | <b>12</b>   | <b>-12</b> |                  |
| <b>"</b>           | <b>9</b>                     | <b>80</b>  | <b>8.88</b> | <b>-16</b> |                  |

# Diagrammatical Presentation of Law of Variable Proportions



## Assumptions of the law:

State of Technology remains the same.  
Input prices remain unchanged,  
Variable factors are homogeneous

## Law of Diminishing Returns and Business Decisions

- A Rational producer will never choose to produce in stage III where Marginal Productivity of variable factor is negative. It will stop at the end of the second stage where Marginal Productivity of the variable factor is Zero. At this point the producer is maximizing the total output and will thus be making the maximum use of the available variable factors.
- A producer will also not choose to produce in Stage I where he will not be making full use of the available resources as the average product of the variable factor continues to increase in this stage.
- A producer will like to produce in the second stage. At this stage Marginal and Average Product of the variable factor falls but the Total Product of the variable factor is maximum at the end of this stage. Thus stage II represents the stage of rational producer decision.

## 3.2 Theory of Costs in the Short Run

- The concepts of production and costs are inseparable facts.
- Cost of production generally stands for the monetary outlays associated with production activity or it is the total expenditures and sacrifices made in the entire process of production and distribution of goods and services. **Types of costs:**
  - **Explicit and implicit costs**
  - ***Economic or opportunity* Vs Accounting Profits**

### ***Explicit costs:***

- are the actual monetary payments or cash outlays that business firms make to outsiders who are suppliers of inputs or resources to them
- usually termed as *accounting* costs because they are out of pocket costs
- Example : the rewards of labor, land, capital and entrepreneur

***Implicit costs:*** - costs standing for the values of non-purchased resources owned and used by firms in their own production activities .

- are costs of firms' own and self-employed resources in carrying activities like the salary of an owner-manager or the estimated rent of a building that belongs to the owner of a firm and etc

Explicit costs +implicit costs=economic costs

## **Economic Vs Accounting Profits**

It is obvious that costs and profits are inseparable concepts of business. Here the main insight is to understand the cost treatment differences and its consequence in profit analysis of business activities.

The term profit refers to the difference between total revenue and total cost. But Economists and Accountants define it differently for they treat costs differently. Economists define costs in terms of opportunity costs and they include implicit costs in profit calculations. **Thus economic profit = total revenue - (implicit + explicit costs)**

In buying factor inputs, the firm will incur costs

Costs are classified as:

**Total Fixed costs** – costs that are not related directly to production – rent, rates, insurance costs, admin costs. They can change but not in relation to output

**Total Variable Costs** – costs directly related to variations in output. Raw materials primarily

$$TC = TFC + TVC$$

**Total Cost** - the sum of all costs incurred in production

$$\mathbf{TC = FC + VC}$$

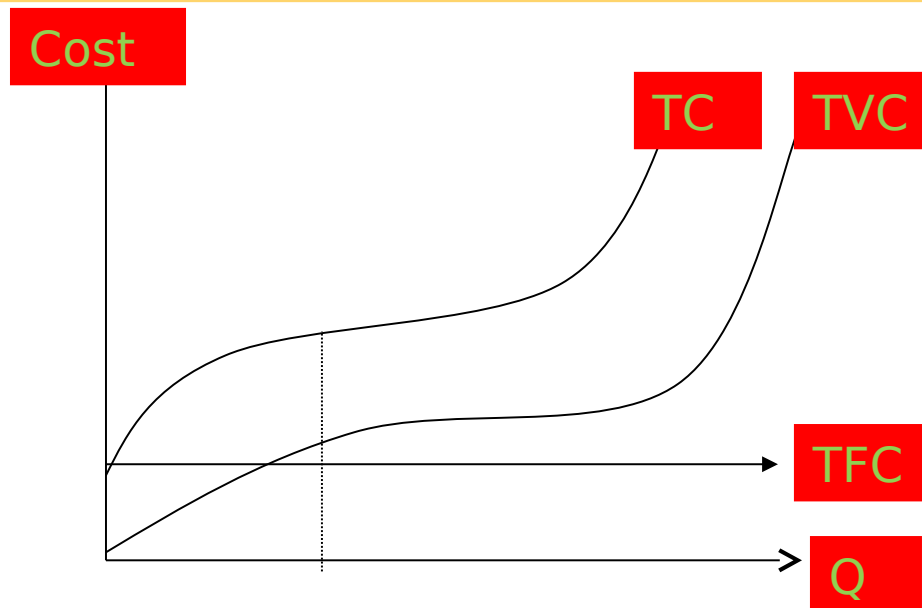
**Average Cost** - the cost per unit of output

$$\mathbf{ATC = TC/Output} \quad \mathbf{=ATC = TFC/Q + TVC/Q; AFC=TFC/Q \& AVC=TVC/Q}$$

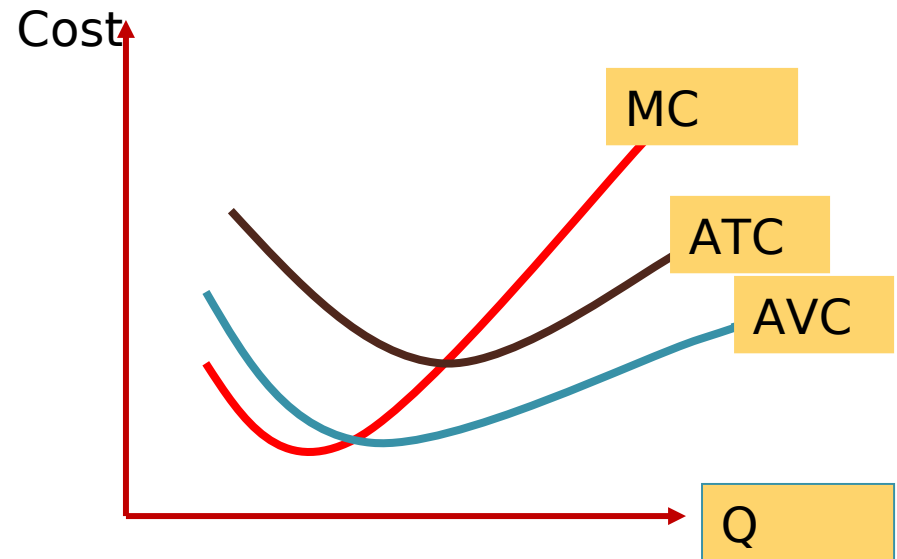
$$\mathbf{= AFC + AVC}$$

**Marginal Cost** - the cost of one more or one fewer units of production

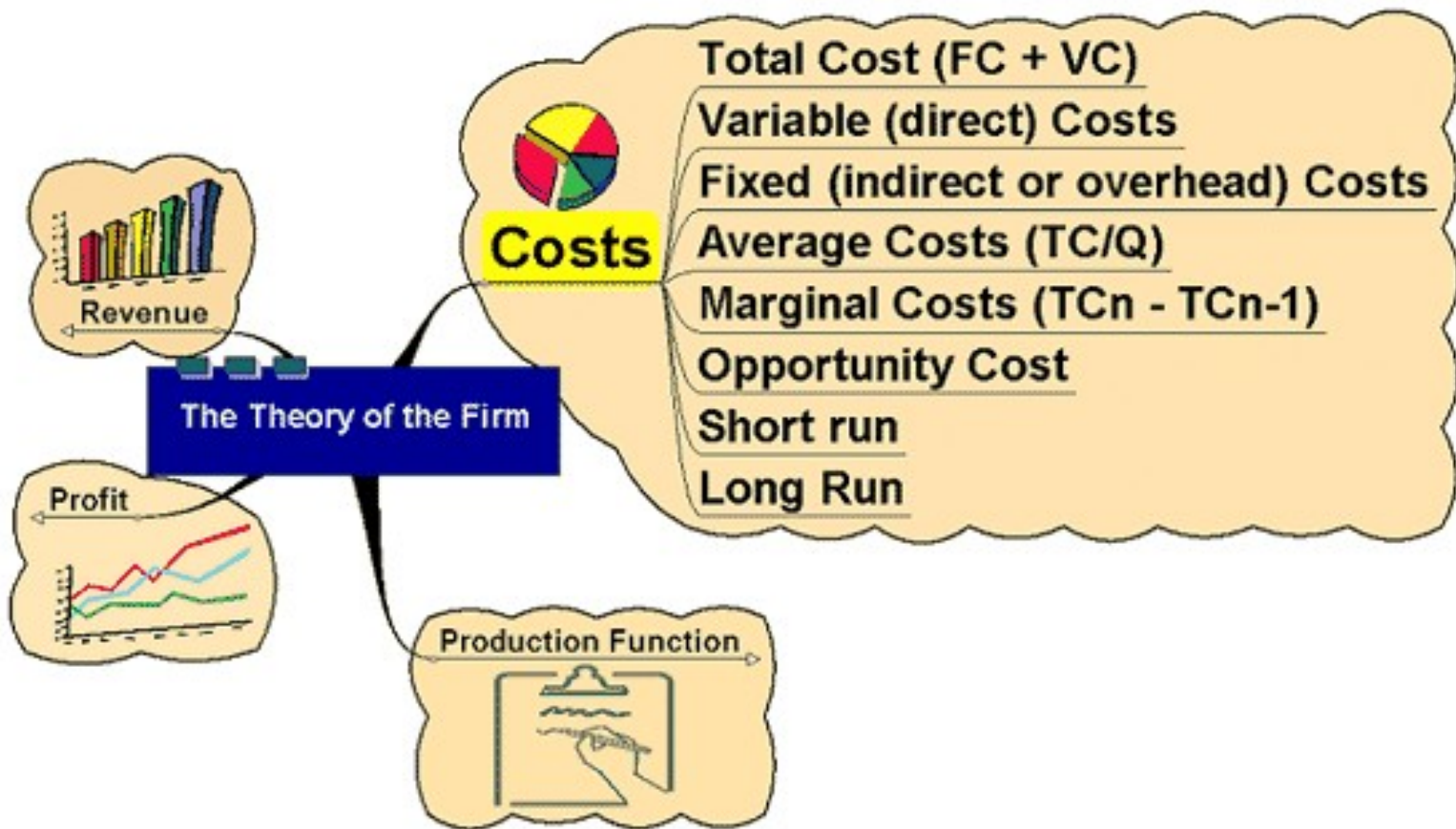
$$\mathbf{MC = \frac{TC_n - TC_{n-1}}{Q_n - Q_{n-1}} units = \frac{\Delta TC}{\Delta Q}}$$



- Both MC, AC and AVC first they decline reach their minimum point and finally starts to rise (they are U shaped)
- But when output increase AFC continuously declines and it becomes rectangular hyperbola



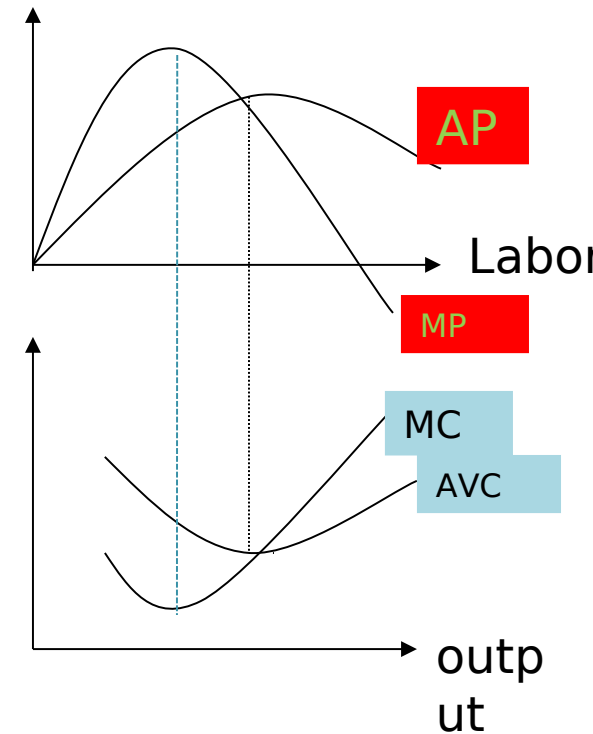
| Q<br>(output) | TFC | TVC | TC  | AFC | AVC  | AC   | MC  |
|---------------|-----|-----|-----|-----|------|------|-----|
| 0             | 60  | 0   | 60  | -   | -    | -    | -   |
| 1             | 60  | 30  | 90  | 60  | 30   | 90   | 30  |
| 2             | 60  | 40  | 100 | 30  | 20   | 50   | 10  |
| 3             | 60  | 45  | 105 | 20  | 15   | 35   | 5   |
| 4             | 60  | 55  | 115 | 15  | 13.5 | 28.5 | 10  |
| 5             | 60  | 75  | 135 | 12  | 15   | 27   | 20  |
| 6             | 60  | 120 | 180 | 10  | 20   | 30s  | 55s |



## 4. Production and cost

- For the output level where MP is above AP, the MC is below AVC.
- For the output level where MP is equal to AP, the MC is equal to AVC.
- For the output level where MP is below AP, the MC is above AVC.
- MP is equal to AP when AP is at its maximum point and hence MC equals AVC when AVC is at its minimum.

Unit



# The long run average cost curves

In the long run the amount of all factors of production can be varied so that there are no fixed costs. The time period corresponding to the long run will be such a condition that the producers can make all the necessary changes in the size of the plant.

The long-run average cost curve is an '**envelope**' of all the short-run ATC curves corresponding to all the different levels of factors of production that are fixed in the short-run.

