

Module 2

Production and Cost

Production

In General, Production means “Any activity of making something material”. In Economics, Production means “transformation of input into output.” In other words, “Production is the process by which inputs are transformed into output.” Production means “Creation or Addition of Utilities”.

Factors of Production

Productive resources required to produce a given product is called Factors of production. In other words, the resources which are used for the production of a thing are called the Factors of Production or the Agents of Production.

Generally, they are classified into Four:

1. Land
2. Labour
3. Capital
4. Organization

1. Land:

Land is the free gift of nature. Land in economics does not mean Soil or Earth's Surface alone but refers to all free gifts of nature which include natural resources, fertility of soil, water, Air etc. “Rent” is the reward for land.

2. Labour:

Labour includes both physical and mental work undertaken for some monetary reward. According to Prof. Marshall – “Any exertion of mind or body undergone partly or wholly with a view to earning some good other than the pleasure derived directly from the work.” The reward for Labour is “Wage”

3. Capital:

Capital means the “Produced means of production.” It can be in the form of machinery, equipment, building etc. The reward of capital is **“Interest.”**

4. Entrepreneurship or Organization:

Entrepreneur is the person who combines the services of other factors and organize production. The reward of Entrepreneur ship is **“Profit”.**

Factors of production are classified into **Fixed factors** and **Variable factors**. Fixed factors are those agents of production which remain fixed in the short period. Variable factors on the other hand vary with the output. But in the long run all factors are variable factors.

Production Function

“Function” is a term borrowed from Mathematics. It expresses the relationship between two variables or two set of variables. **Production Function is the Functional Relationship between physical input and physical output of a firm at any particular time period.**

The output is thus a function of inputs. Mathematically production function can be written as:

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

Q= Quantity of Output L = Land N = labour K = Capital O= Organization

Output is the function of inputs. Hence output becomes the dependent variable and inputs are the independent variables.

Three important concepts are used to explain theory of production

1. Total Product
2. Marginal Product
3. Average Product.

1.Total Product:

Total product of a factor is the amount of total output produced by a given amount of the factor, other factors held constant.

$$TP = \sum MP$$

2. Average Product:

Average product of a factor is the total output produced per unit of the factor employed.

$$AP = Q/L \text{ or } \Delta TP/L$$

3. Marginal Product:

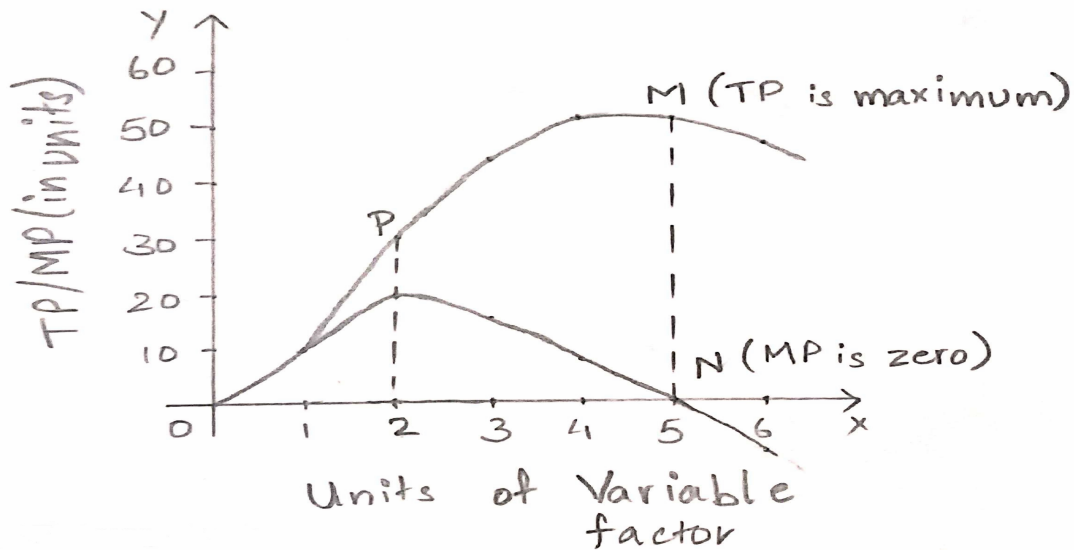
Marginal product of a factor is the addition to the total production by the employment of an extra unit of a factor.

$$MP = \Delta Q/\Delta L \text{ or } MP = \Delta TP/\Delta L \text{ or } MP = TP_n - TP_{n-1}$$

This three concept is explained on the basis of below table.

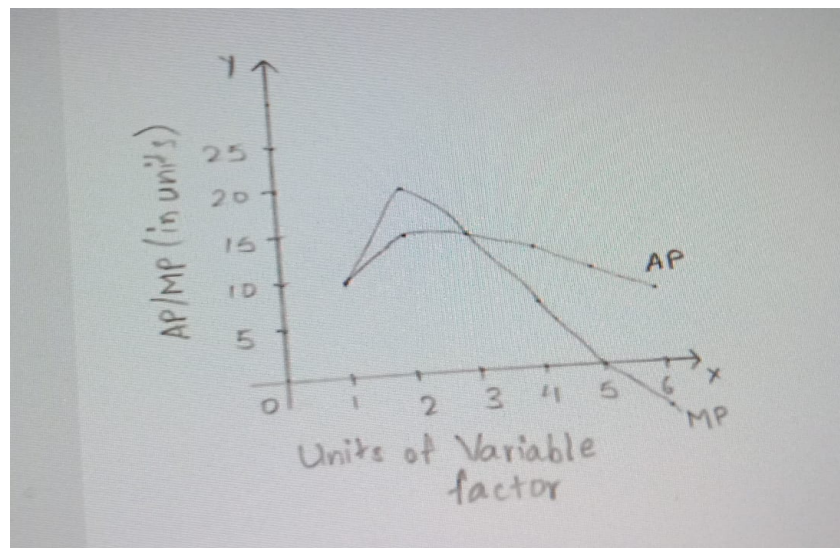
Unit of Labour	TP	AP	MP
0	0	-	-
1	10	10	10
2	30	15	20
3	45	15	15
4	52	13	7
5	52	10.4	0

6	48	8	-4
---	----	---	----



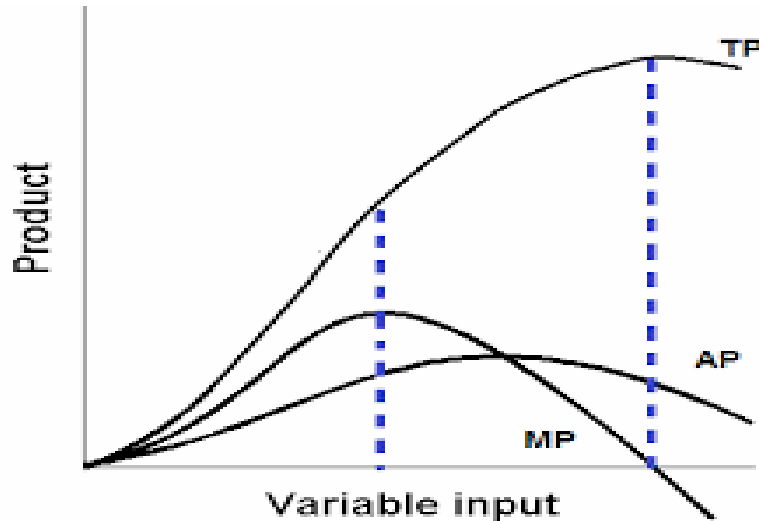
Relationship between TP and MP

1. Initially both TP and MP curves are Increases
2. When MP increases, TP increased at a rate
3. When MP is Zero, TP is maximum



Relationship between AP and MP

1. In first stage MP and AP goes on increasing
2. AP at its maximum is equal to MP
3. MP becomes less than AP



Production Function is divided into two:

1. Short Run of Production Function (Law of Variable Proportion)
2. Long Run Production Function (Returns to Scale)

Law of Variable Proportions

Law of Variable Proportions is also known as “Law of Diminishing Returns” or “Returns to a factor” or “Law of Proportionality”. Law can be firstly developed by Alfred Marshall and this law occupies an important place in economic theory. In the short run all factors of production are fixed. ***LVP explains the production function with one variable factor while the quantities of other factors of production are fixed.*** 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

The law of variable proportion is based on Several assumptions.

(i) 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.

(ii) 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.

(iii) Homogeneous Factor Units:

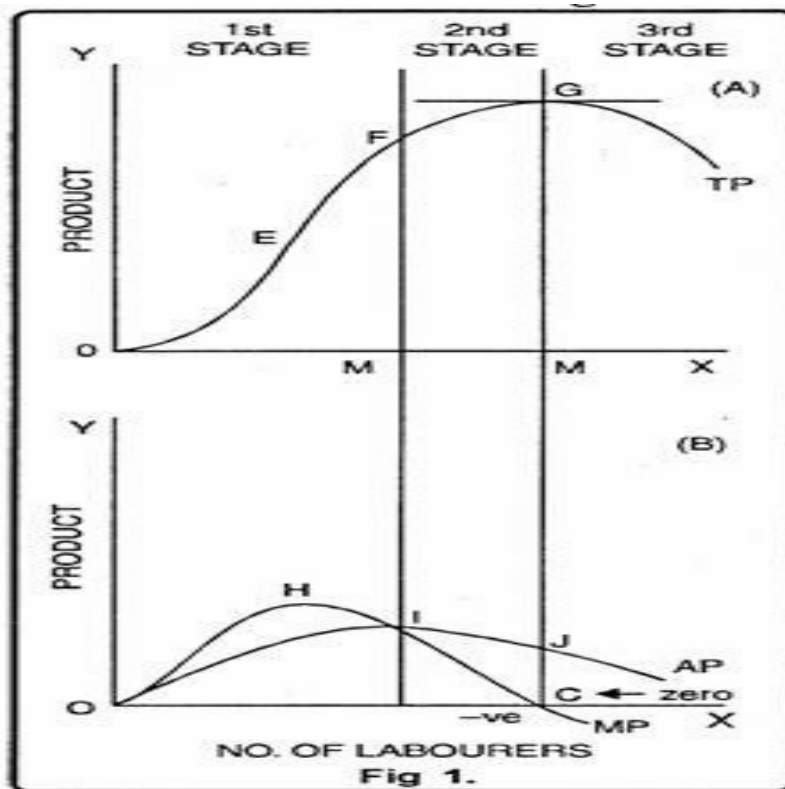
The units of variable factor are homogeneous. Each unit is identical in quality and amount with every other unit.

(iv) Short-Run:

The law operates in the short-run when it is not possible to vary all factor inputs.

The law of variable Proportion is explained on the basis of three stages:

1. Increasing Stage
2. Diminishing Stage
3. Negative Stage



1. Increasing Stage/Returns:

The total output will increase at an increasing rate that is the total output may increase at a rate higher than the increasing in the variable factor. This is the stage of Increasing returns.

2. Diminishing Stage:

The total output will be increasing at a Diminishing rate that is the total output may increase at a rate lower than the increasing in the variable factor. This is the Stage of Diminishing stage.

3. Negative Stage:

The total output will increasing at an Negative /Constant rate that is the total output is exactly proportional to the increasing in the variable factor. This is the Stage of Diminishing/ Constant Stage.

Causes of Increasing Returns

1. Indivisibility of factors
2. Increase in the efficiency of labour

3. A production unit enjoy various economies of large scale production
4. Application of new and better technique of production will reduce the cost

Causes of Diminishing Returns

1. The certain factors are fixed
2. Certain factors are scarce of the production
3. Lack of perfect substitution of factors of production.

Causes of Constant/ Negative Returns

1. Optimum utilization of variable factor
2. Ideal factor ratio

Total Product	Marginal Product	Average Product
Stage I First increases at increasing rate then at diminishing rate.	Increases in the beginning then reaches a maximum and begins to decrease.	First increases, continues to increase and becomes maximum.
Stage II Continues to increase at diminishing rate and becomes maximum.	Continues to diminish and becomes equal to zero.	Becomes equal to MP and then begins to diminish.
Stage III Diminishes	Becomes negative.	Continues to diminish but will always be greater than zero.

Applicability of the Law of Variable Proportions:

The law of variable proportions is universal as it applies to all fields of production. This law applies to any field of production where some factors are fixed and others are variable. That is why it is called the law of universal application.

1. **Application to Agriculture**
2. **Application to Industries:**

Limitations of law of Variable proportions

1. New methods of cultivation
2. New soil
3. Insufficient capital
4. In the case of inventions
5. Population growth

ECONOMIES OF SCALE

Economies of scale refer to the cost advantage experienced by a firm when it increases its level of output. The expansion of a firm or an industry may lead to certain economic advantages which will result in a fall in cost per unit of output. They are called the Economies of Scale. Marshall has classified these economies of large-scale production into internal economies and external economies.

1.Internal Economies

Internal Economies refers to economies that are unique to a firm. Internal economies are those, which are opened to a single factory or a single firm independently of the action of other firms. In other words, Internal economies are those economies which arise in a particular firm as a result of the expansion of that firm and are not shared by the other firms operating that industry. Hence internal economies depend solely upon the size of the firm and are different for different firms.

Types of Internal Economies:

1. Technical Economies
2. Managerial Economies
3. Marketing Economies

4. Financial Economies
5. Risk Bearing Economies

Internal Economies arises from different sources:

1. Division of Labour: leads to Specialization and higher productivity-
Specialization is of two types: Horizontal and Vertical Integration.
2. Utilization of by-products:
3. Up to date Machinery: Most modern machinery and plant
4. Better management:
5. Advertisement
6. Bulk purchases and transportation

2. External Economies

External Economies refer to economies of scale enjoyed by an entire industry. 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.

Principles of External Economies:

1. 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.

2. Economies of Information:

In large industries research work carried on jointly and scientific journals are published.

3. Economies of Specialization:

When an industry grows large, different firms within it specialize in different items.

Isoquant Curve

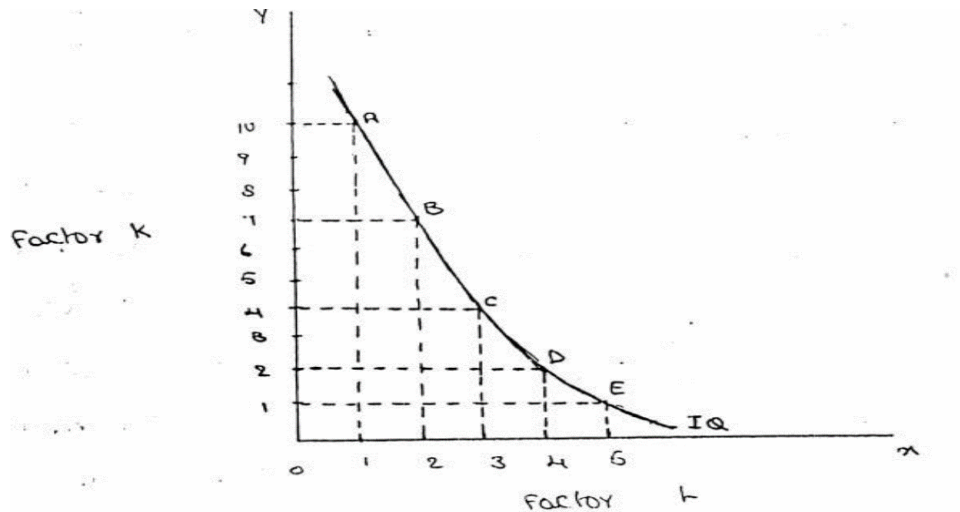
The equilibrium of the producer is explained with the Isoquant curve and Isocost Line. The word “iso” is of Greek origin and means “equal” or “same”. An isoquant curve is also known as iso-product curve, equal-product curve and production indifference curve.

An isoquant is a curve representing the various combinations of two inputs that produce the same amount of output.

In other words, An Isoquant curve is a curve shows various combinations of two inputs like labour and capital which yield the same level of output.

Isoquant curve is explained with the help of schedule and Curve:

Combinations	Labour (L)	Capital (K)
A	1	10
B	2	7
C	3	4
D	4	2
E	5	1



Properties or Features of Isoquant Curve

1. Downward sloping-

Isoquants are downward sloping curves because, if one input increases, the other one reduces.

2. Convex to origin-

Isoquants are convex to the origin. Because the input factors are not perfect substitutes.

3. Two Iso products do not intersect with each other.

4. The higher level of isoquant shows higher level of output and Low level of isoquant shows that the low level of output.

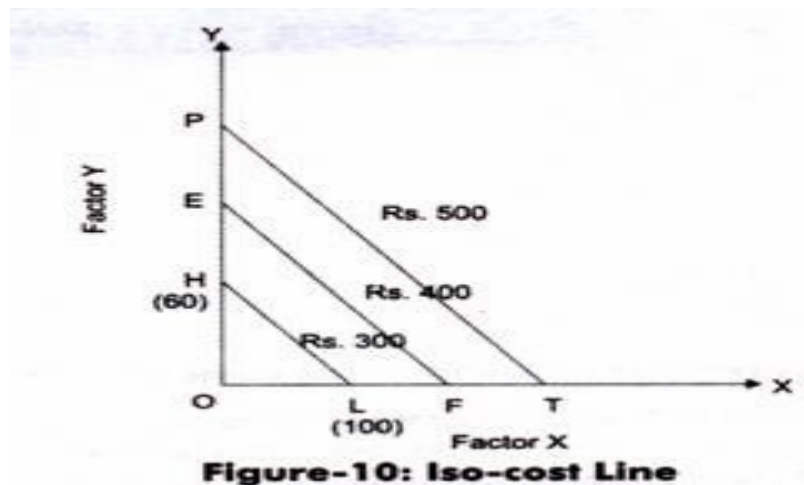
5. Do not touch axes-

The isoquants touches neither X-axis nor Y-axis, as both inputs are required to produce a given product.

The slope of Isoquant curve is MRTS (Marginal Rate of Technical Substitution). 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"

Isocost Line

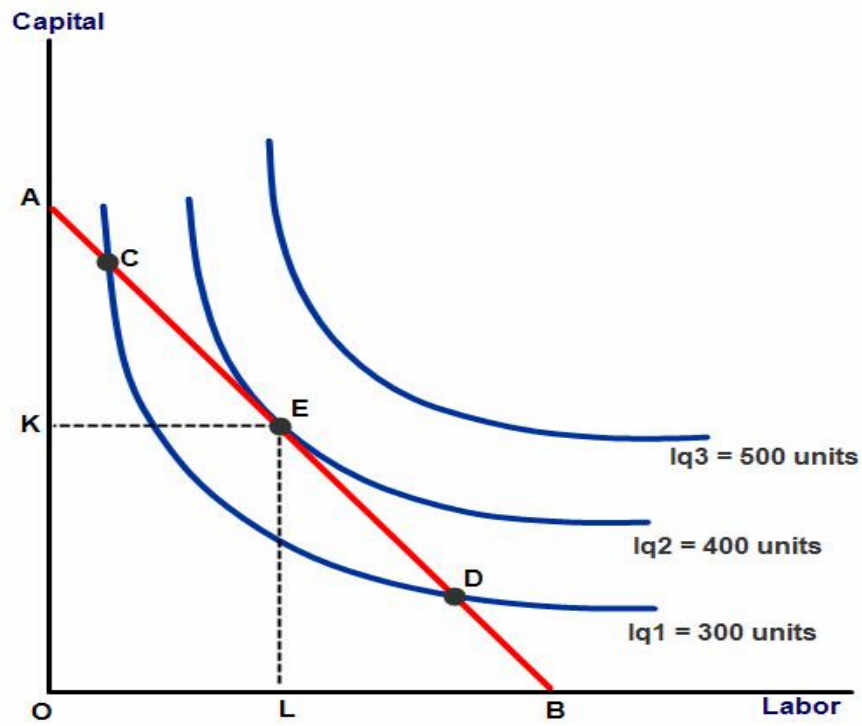
The concept of Isocost Line is the counter part in the theory of production. It shows the various combinations of the two inputs which the producer can buy at given prices and with a given outlay.



Producers Equilibrium

A producer is in equilibrium when he chooses the optimum factor combination to produce a given output. The producers equilibrium is the least cost combination of inputs means minimum possible cost. In other words, Producers Equilibrium is the tangency between isocost line and Isoquant Curve. Producer's equilibrium or optimisation occurs when he earns maximum profit with optimal combination of factors. A profit maximisation firm faces two choices of optimal combination of factors (inputs).

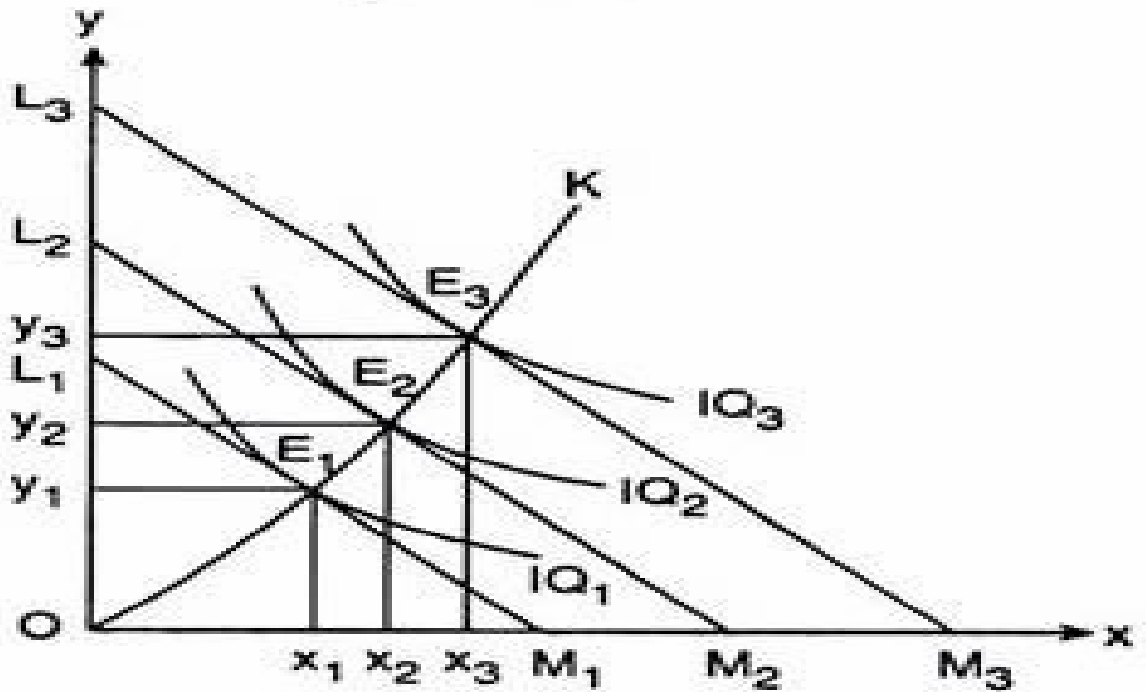
Producers equilibrium is explained with the help of following diagram.



In the above diagram, X axis represent labour and Y axis is Capital. The point E is the producers equilibrium.

Expansion Path

The analysis of producers equilibrium is taking a static view of the producers problem. A line passing through the points of optimum factor combinations for higher and higher levels of output is known as the Expansion Path. In other words, Expansion path is the locus of the points of tangency between isocost line and isoquant curves.



In the above figure, OK is the Expansion path.

Cost Analysis

Cost

Cost is the expenditure incurred by a firm in the production of a commodity. To produce a commodity a firm needs raw materials, labour, buildings etc. the expenses of these items are termed as Cost. Cost is analysed from the producer's point of view. Cost estimates are made in terms of money. Cost calculations are indispensable for management decisions.

Cost Function

Cost Function is the functional relationship between Total Cost and the Volume of Output per unit of time.

$$\text{TC}=\text{f}(\text{Q})$$

Today there are two main approaches in Cost analysis:

- 1. Traditional theory of cost-Marshall**
- 2. Modern theory of cost- PWS ANDREWS**

COST CONCEPTS

1. 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.

2. Private Cost

Private cost is the cost incurred by the producer in the production of a commodity.

2. External Cost:

When a commodity is produced it may cause damages to the environment in the form of air pollution, water pollution etc. these are the External Cost.

3. Social Cost:

Social cost is the total cost to society. Social cost is the sum of Private cost and External cost.

4.Explicit and Implicit Cost:

Explicit cost is the expenses actually met by the producer while producing a commodity. An explicit cost is the monetary payment made by a firm for use of an input owned or controlled by others. Explicit costs are also referred to as accounting costs.

Thus the payments which entrepreneur will have to make to himself for the use of the self-supplied factors are called Implicit cost. **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.

5.Sunk Cost

Sunk cost, in economics and finance, **a cost that has already been incurred and that cannot be recovered**. In economic decision making, sunk costs are treated as bygone and are not taken into consideration when deciding whether to continue an investment project.

6. Real cost:

Real cost is a subjective idea. “Real cost is the pain and trouble of acquiring a product”. Real cost is the actual pain and suffering involved in the production of a commodity.

7. Accounting Cost:

Also known as “Business costs”. Accounting Cost is the money cost that can be recorded in the books of account.

8. Replacement Cost

Replacement cost is the cost incurred when an asset depreciates and it is replaced with the new asset.

9. Money Cost:

Also known as “Nominal cost.” Money cost is the aggregate money expenditure incurred by a firm on the various items entering into the production of a commodity.

10. Fixed and Variable Costs:

In a short run, costs of a firm may be split up into two Fixed and Variable Costs. The costs which remain constant and do not vary with the output are called Fixed costs or Supplementary Costs. Variable costs are those expenses in production, which vary more or less proportionately with the output.

1.Total Cost:

Total cost is the sum of fixed costs and variable costs.

$$TC=TFC+TVC$$

2. Average Cost:

AC is the cost per unit of output. It is the Total Cost (TC) divided by the Total Output(Q).

$$AC=TC/Q$$

AC is the sum of AVC and AFC. ($AC=AVC+AFC$)

3. Marginal Cost:

Marginal Cost is the addition to the total cost when one more unit of the output is produced.

$$MC=TC_n-TC_{n-1} \text{ or } MC= \Delta TC/\Delta Q$$

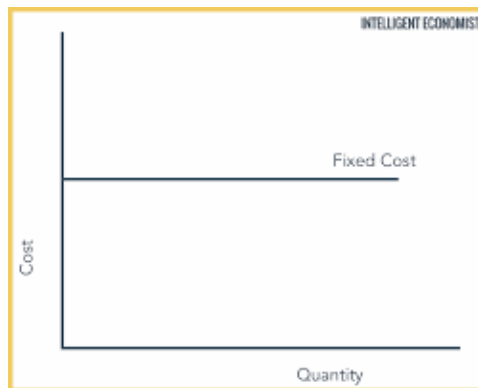
Short Run & Long Run Cost Curves

Short Run is a period in which firm can increase its output only by employing more of the variable factors such as labour and raw materials. In the short run fixed factors such as buildings, machinery etc. remain the same. On the other hand in the Long Run all factors become variable factors. The output can be increased by increasing the quantities of all the factors.

Major short run cost curves are **TFC**, **TVC**, **TC**, **AFC**, **AVC**, **AC** and **MC** and Long run cost curves are **LTC**, **LAC**, **LMC**.

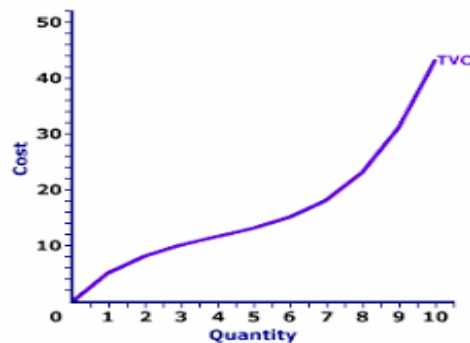
1. TFC (Total Fixed Cost)

It is the cost which does not vary with the level of output. TFC Curve is a horizontal straight line parallel to X axis.



2. TVC (Total Variable Cost)

Variable cost is the cost that vary with the level of output. $TVC = TC - TFC$ The TVC Curve is an inverse S shaped Curve.



3. TC (Total Cost)

Total cost is the sum of total fixed cost and total variable cost.

$$TC = TFC + TVC$$

TC Curve has the same shape of TVC curve/ Inverse S shaped Curve. TC curve is starts from the starting point of TFC curve

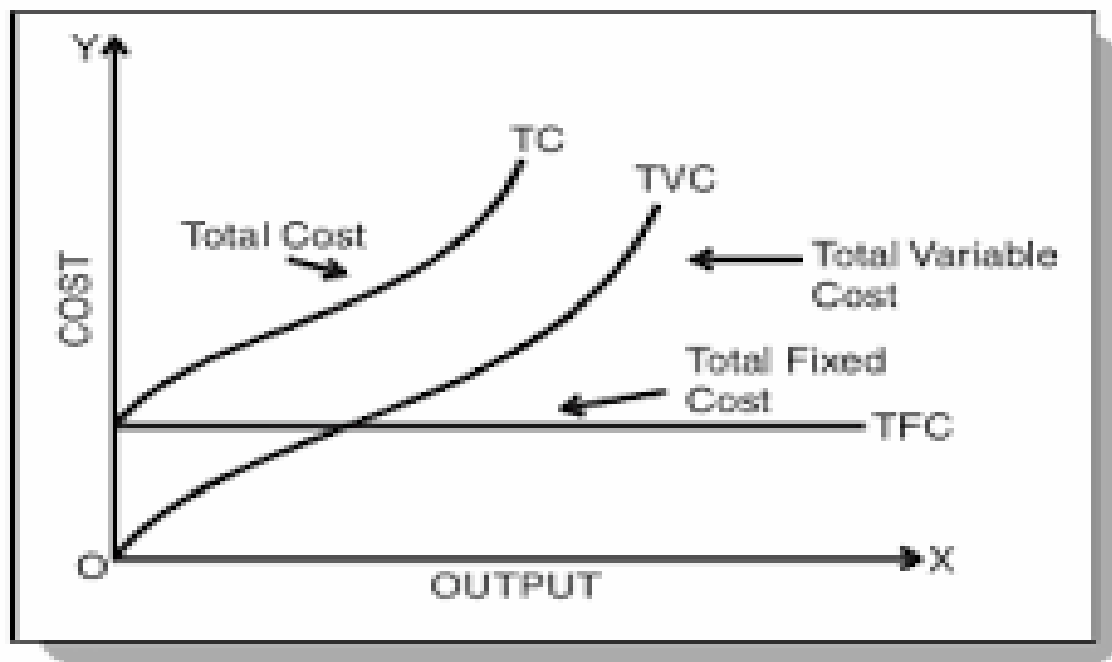
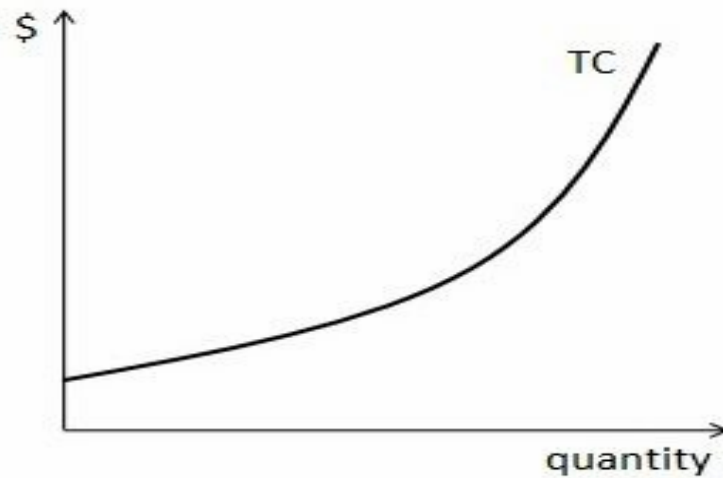


Fig. 5 : Short run Total Cost Curves

4. AFC (Average Fixed Cost)

It is the fixed cost per unit of output. AFC is obtained by dividing TFC by the number of units of output is (Q) produced.

$$\text{AFC} = \text{TFC} / Q$$

AFC Curve is a downward sloping, graphically the Curve is a rectangular hyperbola.

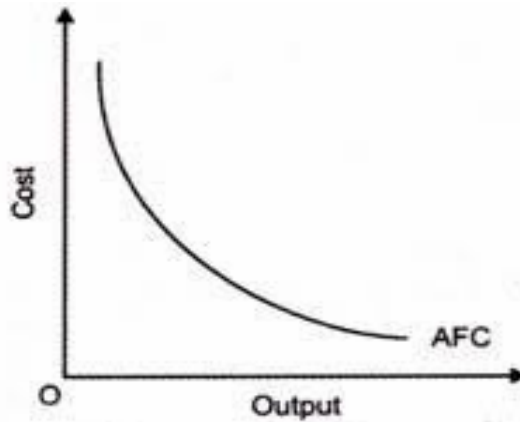


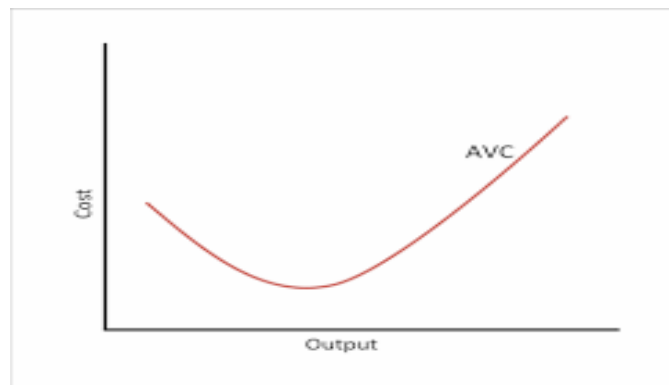
Figure-6: AFC Curve

5. AVC (Average Variable Cost)

It is the variable cost per unit of output.

$$AVC = TVC/Q$$

AVC curve is a U shaped

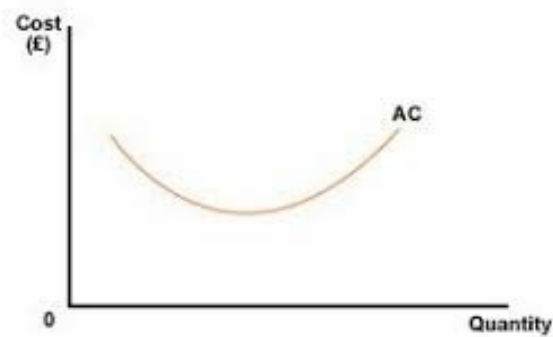


6. AC (Average Cost)

AC is the cost per unit of output produced.

$$AC = TC/Q, AC = AFC + AVC$$

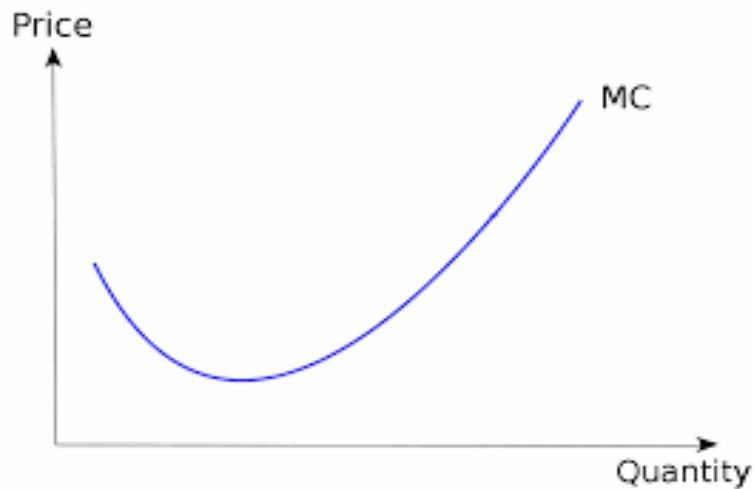
AC Curve is U shaped



7. MC (Marginal Cost)

MC is the addition to total cost when one, more unit of output is produced. MC is derived from TC. MC is U Shaped.

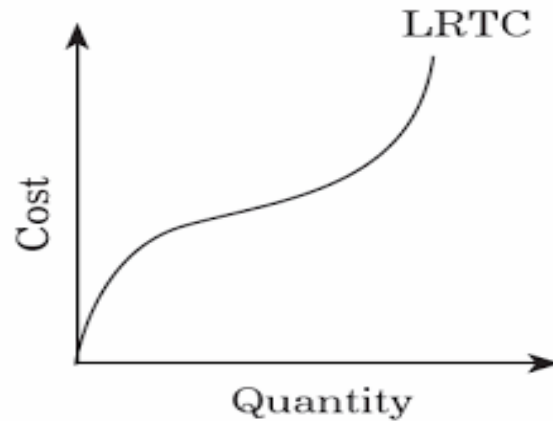
$$MC = TC_n - TC_{n-1} \text{ or } MC = \Delta TC / \Delta Q$$



Long Run Cost Curves

1. Long Run Total Cost (LTC)

It is the minimum cost at which a given level of output can be produced in the long run. LTC curve is derived from the Short run Total Cost Curves. LTC curve is an inverse S shaped.



2. Long Run Average Cost (LAC)

LAC is the cost per unit of output in the long run. It is also derived from the Short run Average Cost Curves. LAC is U shaped.

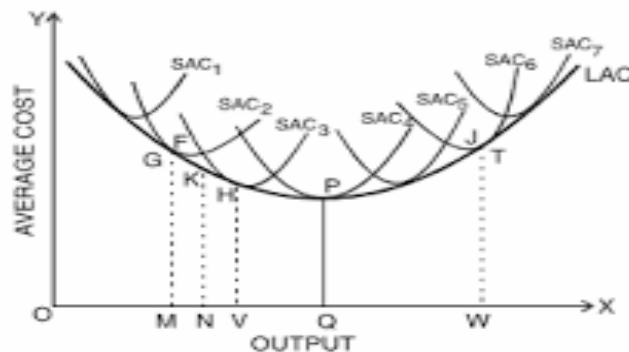


Fig.2 : Long run Average Cost Curves

3. Long Run Marginal Cost (LMC)

It is the addition to total cost when one more units of output is produced in the long run. It is derived from the Short run Marginal Cost Curves. LMC is also U shaped one.

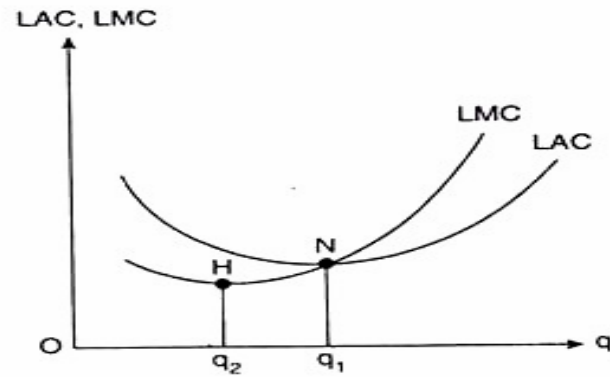


Fig. 9.23 Relation between the LMC and the LAC curves

Units	TFC	TVC	TC	AFC	AVC	AC	MC
0	40	0	40	0	0	0	
1	40	20	60				
2	40	30	70				
3	40	32	72				
4	40	36	76				
5	40	38	78				
6	40	40	80				
7	40	46	86				
8	40	48	88				

Average cost, average fixed cost can be shown with the help of a table 5.

Table 5.

Units	TFC	TVC	TC	AC $\left(\frac{TC}{q}\right)$	AFC $\left(\frac{TFC}{q}\right)$	AVC $\left(\frac{TVC}{q}\right)$
0	40	0	40	0	0	0
1	40	20	60	60	40	20
2	40	30	70	35	20	15
3	40	32	72	24	13.3	10.7
4	40	34	74	18.5	10.0	8.5
5	40	36	76	15.2	8	7.2
6	40	38	78	13.0	6.6	6.3
7	40	40	80	11.4	5.7	5.7
8	40	46	86	10.7	5.0	5.7
9	40	48	88	9.8	4.4	5.4

$$AC = \frac{TC}{q} \text{ Or } AFC + AVC$$

$$AFC = \frac{TFC}{q}$$

$$AVC = \frac{TVC}{q}$$

$$TC = TFC + TVC$$

Revenue

Revenue is the income from the sale of output. Revenue is explained on the basis of three concepts:

1. Total Revenue
2. Average Revenue
3. Marginal Revenue

Total Revenue (TR)

It is the total money income earned by a firm from the sale of its output. It is obtained by Multiplying quantity (Q) by Price (P).

$$TR = P \times Q$$

Average Revenue (AR)

It is the revenue per unit of output sold.

$$AR = TR/Q \text{ or } AR \text{ is the Price}$$

Marginal Revenue (MR)

It is the addition to total revenue by selling one or more unit of output.

$$\mathbf{MR = TR_n - TR_{n-1}}$$

Or

$$\mathbf{MR = \Delta TR / \Delta Q}$$

The relationship between TR, AR and MR

Units of the Product	TR	AR	MR
1	12	12	12
2	20		
3	26		
4	30		
5	30		
6	28		
7	24		