



CHAPTER – 3

THEORY OF PRODUCTION AND COST

Unit 1

Theory
of
Production

Learning Objectives

At the end of this unit, you will be able to :

- ◆ know the meaning of production in Economics.
- ◆ know about the various factors of production.
- ◆ understand the difference between short run and long run.
- ◆ have an insight into the laws of variable proportion and returns to scale.
- ◆ understand how a producer optimises production.
- ◆ understand economies and diseconomies of scale.

1.0 MEANING OF PRODUCTION

Production is a very important economic activity. The standard of living in the ultimate analysis, depends on the volume and variety of goods and services produced in a country. In fact, the performance of an economy is judged by the level of its production. Those countries which produce goods in large quantities are rich and those which produce little of them are poor. Thus, the amount of goods and services an economy is able to produce determines the richness or poverty of that economy. The U.S.A. is a rich country just because its level of production is high. India is not so because its level of production is not very high.

What exactly do we mean by production in Economics? In common parlance the term 'production' is used for an activity of making something material. The growing of wheat, rice or any other agricultural crop by farmers and manufacturing of cloth, radio-sets, wool, machinery or any other industrial product is often referred to as production. But, in Economics the word 'production' is used in a wider sense. In Economics, by production, we mean the process by which man utilises or converts the resources of nature, working upon them so as to make them satisfy human wants. In other words, production is any economic activity which is directed towards the satisfaction of the wants of people by converting physical inputs into physical outputs. Whether it is the making of material goods or providing any service, it is included in production provided it satisfies the wants of some people. So, in Economics, if making of cloth by an industrial worker is production, the services of the retailer who delivers it to consumers is also production. Similarly, the work of doctors, lawyers, teachers, actors, dancers, etc. is production since the services are provided by them to satisfy the wants of those who pay for them. The want satisfying power of goods and services is called utility. Production can also be defined as creation or addition of utility.

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".

It should be noted that production should not be taken to mean as creation of matter because, according to the fundamental law of science, man cannot create matter. What a man can do is only to create or add utility. When a man produces a table, he does not create the matter of which the wood is composed of. He only transforms wood into a chair. By doing so, he adds utility to wood which did not have utility before.



The money expenses incurred in the process of production, i.e., for transforming resources into finished products constitute the cost of production.

Production consists of various processes to add utility to natural resources for gaining greater satisfaction from them by :

- (i) Changing the form of natural resources. Most manufacturing processes consist of taking raw material and transforming them into some items possessing utility, e.g., changing the form of a log of wood into a table or changing the form of iron into a machine. This may be called conferring utility of form.
- (ii) Changing the place of the resources, from the place where they are of little or no use to another place where they are of greater use. This utility of place can be obtained by :
 - (a) extraction from earth e.g., removal of coal, minerals, gold and other metal ores from mines and supplying them to markets.
 - (b) transferring goods from where they give little or no satisfaction, to places where their utility is more, e.g., tin in Malaya is of little use until it is brought to the industrialised centres where necessary machinery and technology are available to produce metal boxes for packing. Another example is : apples in Kashmir orchards have some use to farmers. But when the apples are transported to markets where human settlements are thick and crowded like the city centres, they afford more satisfaction to greater number of people, rather than to the farmers in the Kashmir apple orchards.

These examples only emphasise the additional utility conferred on all goods, by all forms of transportation systems, by transport workers and by the agents who assist in the movement and marketing of goods.

- (iii) Making available materials at times when they are not normally available e.g., harvested foodgrains are stored for use till next harvest. Canning of seasonal fruits is undertaken to make them available during off season. This may be called conferring of utility of time.
- (iv) Making use of personal skills in the form of services, e.g., those of organisers, merchants, transport workers etc.

The fundamental purpose of all these activities is the same, namely to create utility in some manner. So production is nothing but the creation of utilities in the form of goods and services. For example, in the production of a woollen suit, utility is created in some form or the other. Firstly wool is changed into woollen cloth at the spinning and weaving mill (utility created by changing the form). Then, it is taken to a place where it is to be sold (utility added by transporting it). Since woollen clothes are used only in winter, they will be retained until such time when they are required by purchasers (time utility). In the whole process, services of various groups of people are utilised (as that of mill workers, shopkeepers, agents etc.) to contribute to the enhancement of utility. Thus, the entire process of production is nothing but creation of *form utility, place utility, time utility and/or personal utility*.

1.1 FACTORS OF PRODUCTION

The process of producing goods in a modern economy is very complex. A good has to pass through many stages and many hands until it reaches the consumer's hands in a finished form. Land, labour, capital and entrepreneurial ability are all the factors or resources which

make it possible to produce goods and services. Even a small piece of bread cannot be produced without the active participation of these factors of production. While land is a free gift of nature and refers to natural resources, the human endeavour is classified functionally and qualitatively into three main components namely, labour, capital and entrepreneurial skills.

We may discuss these factors of production briefly in the following paragraphs.

1.1.0 Land : The term 'land' is used in a special sense in Economics. It does not mean soil or earth's surface alone, but refers to all free gifts of nature which would include besides the land, in common parlance, natural resources, fertility of soil, water, air, natural vegetation etc. It becomes difficult at times to state precisely as to what part of a given factor is due solely to the gift of nature and what part belongs to human effort made on it in the past. Therefore, as a theoretical concept, we may list the following characteristics which would qualify a given factor to be called land :

- (i) **Land is nature's gift :** Land is a free gift of nature. It is neither created nor destroyed by man.
- (ii) **Supply of land is fixed :** Land is strictly limited in quantity. It is different from the other factors of production in that, for practical purposes, it is permanently in being; no change in demand can affect the amount of land in existence. In other words, the supply of land is perfectly inelastic from the point of view of the economy. However, it is relatively elastic from the point of view of a firm.
- (iii) **It has indestructible powers :** According to Ricardo, the production power of soil is indestructible in the sense that the properties of land cannot be destroyed. Even if its fertility gets depleted, it can be restored.
- (iv) **It is a passive factor :** Land cannot be shifted from one place to another place. The natural factors typical to a given place cannot be shifted to other places. It may, however be noted that man has been able to shift water from one place to another e.g. Rajasthan Canal. Land can however, be used for varied purposes, though its suitability in all the uses is not the same.
- (v) **It has different uses :** Land is said to be a specific factor of production in the sense that it does not yield any result unless human efforts are employed. Land varies in fertility and uses.

1.1.1 Labour : The term 'labour', means only mental or physical exertion directed to produce goods or services. Any sacrifice of mind or body undergone partly or wholly with a view to secure an income apart from the pleasure derived directly from the work is termed as labour. In other words, it refers to various types of human efforts which require the use of physical exertion, skill and intellect. It is, however, difficult to say that in any human effort all the three are not required; the proportion of each might vary. Labour, to have an economic significance, must be one which is done with the motive of some economic reward. Anything done out of love and affection, although very useful in increasing human well-being, is not labour in the economic sense of the term. It implies that any work done for the sake of pleasure or love does not represent labour in Economics. It is for this reason that the services of a house-wife are not treated as labour, while those of a maid servant are treated as labour. If a person sings before his friends just for the sake of pleasure, it is not considered as labour despite the exertion involved in it. On the other hand, if a person sings against payment of some fee, then this activity signifies labour.



Characteristics of labour :

- (1) **Human Effort** : Labour, as compared with other factors is different. It is connected with human efforts whereas others are not directly connected with human efforts. As a result of this, there are certain human and psychological considerations which may come up unlike in the case of other factors.
- (2) **Labour is perishable** : Labour is highly 'perishable' in the sense that a day's labour lost cannot be completely recovered because the expenditure on maintenance has to be there. Whatever is lost in a day cannot be recovered wholly by extra work next day. In other words, a labourer cannot store his labour and so he has no reserve price for his labour.
- (3) **Labour is inseparable from the labourer** : It implies that whereas labour is sold, the producer of labour retains the capacity to work. Thus, a labourer is the source of his own labour power.
- (4) **Labour power differs from labourer to labourer** : On the basis of labour power, labour may be classified as unskilled labour, semi-skilled labour and skilled labour. Labour power depends upon physical strength, education, skill and the motivation to work.
- (5) **All labours are not productive** : (i.e.) that all efforts are not sure to produce resources.
- (6) **Labour has poor bargaining power** : Labour has a weak bargaining power. It is because the labourer is economically weak while the employer is economically powerful although things have changed a lot in favour of labour during the 20th century.
- (7) **Choice between hours of labour and hours of leisure** : A labourer has to make a choice between the hours of labour and the hours of leisure. The supply of labour and wage rate are directly related. It implies that, as the wage rate increases the labourer tends to increase the supply of labour by reducing the hours of leisure. However, beyond a minimum level of income, the labourer reduces the supply of labour and increases the hours of leisure in response to further rise in the wage rate. That is, he prefers to have more of rest and leisure than earning more money.
- (8) **Labour is mobile** : Labour is a mobile factor. Apparently, workers can move from one job to another or from one place to another. But, in reality there are many obstacles in the way of free movement of labour from job to job or from place to place.

1.1.2 Capital : We may define capital as that part of wealth of an individual or community which is used for further production of wealth. In fact, capital is a stock concept which yields a periodical income which is a flow concept. It is necessary to understand the difference between capital and wealth. Whereas wealth refers to all those goods and human qualities which are useful in production and which can be passed on for value, only a part of these goods and services can be characterised as capital because if these resources are lying idle they will constitute wealth but not capital. Capital has been rightly defined as 'produced means of production'. This definition distinguishes capital from both land and labour because both land and labour are not produced factors. They are primary or original factors of production but capital is not a primary or original factor; it is a produced factor of production. It has been produced by man by working with nature. Therefore, capital may well be defined as man made instruments of production. Machine tools and instruments, factories, dams, canals, transport equipment etc., are some of the examples of capital. All of them are produced by man to help in the production of further goods.

Types of Capital:

Fixed capital is that which exists in a durable shape and renders a series of services over a period of time. For example tools, machines, etc.

Circulating capital is another form of capital which performs its function in production in a single use and is not available for further use. For example, seeds, raw materials, etc.

Real capital refers to physical goods such as building, plant, machines, etc.

Human capital refers to human skill and ability. This is called human capital because a good deal of investment has gone into creation of these abilities in humans.

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, goodwill, patent rights, etc.

Individual capital is the personal property owned by an individual or a group of individuals.

Social Capital is what belongs to the society as a whole in the form of roads, bridges, etc.

Capital formation : Capital formation means a sustained increase in the stock of real capital in a country. In other words, capital formation involves production of more capital goods like, machines, tools, factories, transport equipments, electricity etc. which are used for further production of goods. Capital formation is also known as investment. The need for capital formation or investment is realised not merely for replacement and renovation but for creating additional productive capacity. In order to accumulate capital goods, some current consumption is to be sacrificed and savings of current income are to be made. Savings are also to be channelised into productive investment. The greater the extent that people are willing to abstain from present consumption, the greater the extent of savings and investment that society will devote to new capital formation. If a society consumes all what it produces and saves nothing the future productive capacity of the economy will fall as the present capital equipment wears out. In other words, if the whole of the current present capacity is used to produce consumer goods and no new capital goods are made, production of consumer goods in the future will greatly decline. It is prudent to cut down some of the present consumption and direct part of it to the making of capital goods such as tools and instruments, machines and transport facilities, plant and equipment etc.. They will not only increase the efficacy of production efforts but also will make possible the expansion of output of consumer goods in the future.

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

1. **Savings** : The basic factor on which formation of capital depends is the ability to save. The ability to save depends upon the income of an individual. Higher incomes are generally followed by higher savings. This is because, with an increase in income the propensity to consume comes down, and the propensity to save increases. This is true not only for an individual but also for the economy as a whole. A rich country has greater ability to save and thereby can get richer quickly compared to a poor country which has no ability to save and therefore has limited capacity for growth in national income, given the capital output ratio.



It is not only the ability to save, but the willingness to save also counts a great deal. Willingness to save depends upon the individual's concern about his future as well as upon the social set-up in which he lives. If an individual is farsighted and wants to make his future secure, he will save more. Moreover, the government can enforce compulsory savings on the people by imposing taxes. In recent years, business community's savings and government's savings are also becoming important.

2. **Mobilisation of savings** : It is not enough that people save money; what is required is that the saved money enters into circulation and facilitates the process of capital formation. There should be a wide spread network of banking and other financial institutions to collect public savings and to take them to prospective investors. In this process, the state has a very important and positive role to play both in generating savings through various fiscal and monetary incentives and in channelising the savings towards priority needs of the community so that there is not only capital generation but also socially beneficial type of capital formation.
3. **Investment** : The process of capital formation gets completed only when the real savings get converted into real capital assets. An economy should have an entrepreneurial class which is prepared to bear the risk of business and invest savings in productive avenues so as to create new capital assets.

1.1.3 Entrepreneur : Having explained the three factors namely land, labour and capital, we now turn to the explanation of the fourth important factor, namely, the entrepreneur. It is not enough to say that production is a function of land, capital and labour. There must be some factor which mobilises these factors, combines them in the right proportion, initiates the process of production and bears the risks involved in it. This factor is known as the entrepreneur. He has also been called the organiser, the manager or the risk taker. But, in these days of specialisation, the tasks of manager or organiser has become different from those of the entrepreneur. While organisation and management involve decision-making of routine and non-routine types, the task of the entrepreneur is to initiate production work and to bear the risks involved in it.

Functions of an entrepreneur : An entrepreneur performs the following functions in general :

- (i) **Initiating a business enterprise and resource co-ordination** : The first and the foremost function of an entrepreneur is to initiate a business enterprise. For this, he has to collect different factors of production such as labour, capital, land etc. and bring about co-ordination among them. These various other factors of production are paid fixed contractual remuneration : labour at fixed rate of wages, land or factory building at a fixed rent for its use and capital at a fixed rate of interest. The surplus, if any, after all the fixed costs and variable costs are met, accrues to the entrepreneur as his reward for his efforts and risk-taking. Thus, the reward for an entrepreneur, that is a profit, is not fixed. He may earn profits, or incur losses. Other factors get their payment irrespective of whether the entrepreneur makes profits or losses.
- (ii) **Risk bearing or uncertainty bearing** : The ultimate responsibility for the success and survival of business lies with the entrepreneur. What is planned and anticipated by the entrepreneur

may not come true and the actual course of events may differ from what was anticipated and planned. The economy is dynamic and changes occur everyday. The demand for a commodity, the cost structure, fashions and tastes of the people, and government's policy regarding taxation, credit, interest rate etc. may change. All these changes bring about changes in the cost or demand conditions of a business firm. It may happen that as a result of certain broad changes which were not anticipated by the entrepreneur, the firm has to incur heavy losses. Thus, the entrepreneur has to bear these financial risks. Apart from financial risks, the entrepreneur also faces technological risks which arise due to the inventions and improvements in techniques of production, making the existing techniques and machines obsolete. The entrepreneur has to assess and bear the risks. These risks are different from the risks like risks of fire, theft, burglary etc. which can be insured against. These risks which cannot be insured are also called uncertainties and the entrepreneur earns profits because he bears uncertainty in a dynamic economy where changes occur everyday.

Innovations: One of the important functions of an entrepreneur is to introduce innovations. Innovations, in a very broad sense, include the introduction of new or improved production methods, utilisation of new or improved sources of raw-materials, adoption of new or improved forms of organisation, introduction of new or improved products, opening of new or improved markets etc. According to Schumpeter, the task of the entrepreneur is to continuously introduce new innovations.

1.2 PRODUCTION FUNCTION

Production function states the functional relationship between inputs and output i.e., the maximum amount of output that can be produced with given quantities of inputs under a given state of technical knowledge. It can also be defined as the minimum quantities of various inputs that are required to yield a given quantity of output. The output takes the form of volume of goods or services and the inputs are the different factors of production i.e., land, labour, capital and enterprise. Samuelson describes production function as the relationship between the maximum amount of output that can be produced and the input required to make that output. It is defined for a given state of technology.

Definition of Production Function:

According to Richard H. Leftwich, "The term production function is applied to the physical relationship between a firm's input of resources and its output of goods or services per unit of time leaving prices aside".

In short, the production function is a catalogue of output possibilities. The production function can be algebraically expressed in an equation in which the output is the dependent variable and inputs are the independent variables. The equation can be expressed as:

$$q = f(a, b, c, d, \dots, n)$$

where 'q' stands for the rate of output of given commodity and a,b,c,d.....n, are the different factors (inputs) and services used per unit of time.



The production function of a firm can be studied in the context of short period or long period. Short period or short run is that period of time which is too short for a firm to install a new capital equipment to increase production. It implies that capital is a fixed factor in the short run and the production function is studied by holding the quantities of capital fixed, while varying the amount of other factors (labour, raw material etc.) Symbolically, $Q = T(K, L)$. This is done when the law of variable proportion is derived. The production function can also be studied in the long run. The long run is a period of time (or planning horizon) in which all the factors of production are variable. It is a time period when the firm will be able to install new machines and capital equipments apart from increasing the units of labour. The behaviour of production when all factors are varied is the subject matter of the law of returns to scale.

Assumptions of Production Function:

The production function is based on certain assumptions;

1. It is related to a particular unit of time.
2. The technical knowledge during that period of time remains constant.
3. The producer is using the best technique available.

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

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

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.

1.2.1 Law of variable proportions : Before discussing this law, it would be appropriate to understand the meaning of total product, average product and marginal product.

Total Product (TP) : Total product is the total output resulting from the efforts of all the factors of production combined together at any time. If the inputs of all but one factor are held constant, the total product will vary with the quantity used of the variable factor. Column (1) and (2) of Table 1 represent a total product schedule.

Table 1 : Product Schedule

Quantity of labour	Total Product (TP)	Average Product (AP)	Marginal Product (MP)
(1)	(2)	(3)	(4)
1	100	100.0	100
2	210	105.0	110
3	330	110.0	120
4	440	110.0	110
5	520	104.0	80
6	600	100.0	80
7	670	95.7	70
8	720	90.0	50
9	750	83.3	30
10	760	76.0	10
11	740	67.2	-20

We find that when one unit of labour is employed, the total product is 100 units. When two units of labour are employed, the total product rises to 210 units. The total product goes on rising as more and more units of labour are employed. With 10 units of labour, the total product rises to 760 units. When 11 units of labour are employed, total product falls to 740 units.

Average Product (AP) : Average product is the total product per unit of the variable factor. It is shown as a schedule in column (3) of Table 1. When one unit of labour is employed, average product is 100, when two units of labour are employed, average product rises to 105. This goes on, as shown in Table 1.

Marginal Product (MP) : Marginal product is the change in total product per unit change in the quantity of variable factor. In other words, it is the addition made to the total production by an additional unit of input.

The computed value of the marginal product appears in the last column of Table 1. For example, the MP corresponding to 4 units is given as 110 units. This reflects the fact that an increase in labour from 3 to 4 units, increased output from 330 to 440 units.

Relationship between Average Product and Marginal Product : Both average product and marginal product are derived from the total product. Average product is obtained by dividing total product by the number of units of variable factor and marginal product is the change in total product resulting from a unit increase in the quantity of variable factor. The various points of relationship between average product and marginal product can be summed up as follows :

- (i) when average product rises as a result of an increase in the quantity of variable input, marginal product is more than the average product.



- (ii) 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.
- (iii) when average product falls, marginal product is less than the average product.

Table 1 and Figure 1 confirm the above points of relationship.

The law of variable proportions or the law of diminishing returns examines the production function with one factor variable, keeping quantities of other factors fixed. In other words, it refers to input-output relationship, when the output is increased by varying the quantity of one input. This law operates in the short run 'when all the factors of production cannot be increased or decreased simultaneously (for example, we cannot build a plant or dismantle a plant in the short run).

The law operates under certain assumptions which are as follows :

1. The state of technology is assumed to be given and unchanged. If there is any improvement in technology, then marginal and average product may rise instead of falling.
2. There must be some inputs whose quantity is kept fixed. This law does not apply to cases when all factors are proportionately varied. When all the factors are proportionately varied, laws of returns to scale are applicable.
3. The law does not apply to those cases where the factors must be used in fixed proportions to yield output. When the various factors are required to be used in fixed proportions, an increase in one factor would not lead to any increase in output i.e., marginal product of the variable factor will then be zero and not diminishing.
4. We consider only physical inputs and outputs and not economic profitability in monetary terms.

The law states that as we increase the quantity of one input which is combined with other fixed inputs, the marginal physical productivity of the variable input must eventually decline. In other words, an increase in some inputs relative to other fixed inputs will, in a given state of technology, cause output to increase; but after a point, the extra output resulting from the same addition of extra inputs will become less and less.

The behaviour of output when the varying quantity of one factor is combined with a fixed quantity of the others can be divided into three distinct stages or laws. In order to understand these three stages or laws, we may graphically illustrate the production function with one variable factor. This is done in Figure 1.

In this figure, the quantity of variable factor is depicted on the X axis and on the Y-axis is measured the Total Product (TP), Average Product (AP) and Marginal Product (MP). As the figure shows TP curve goes on increasing upto to a point and after that it starts declining. AP and MP curves first rise and then decline; MP curve starts declining earlier than the AP curve.

The behaviour of these Total, Average and Marginal Products of the variable factor consequent on the increase in its amount is generally divided into three stages (laws) which are explained below.

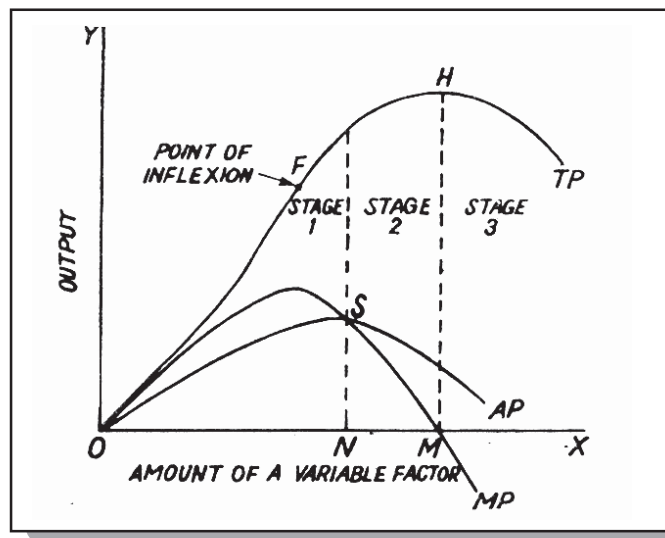


Fig. 1 : Law of variable proportions

Stage 1 : The Law of Increasing Returns : In this stage, total product increases at an increasing rate upto a point (in figure upto point F), marginal product also rises and is maximum at the point corresponding to F and average product goes on rising. From point F onwards during the stage one, the total product goes on rising but at a diminishing rate. Marginal product falls but is positive. The stage 1 ends where the AP curve reaches its highest point.

Thus in the first stage the AP curve rises throughout whereas the marginal product curve first rises and then starts falling after reaching its maximum. It is to be noted that the marginal product although starts declining, remains greater than the average product throughout the stage so that average product continues to rise.

Explanation of the law : The law of increasing returns operates because, in the beginning the quantity of fixed factors is abundant relative to the quantity of the variable factor. As more units of variable factor are added to the constant quantity of the fixed factors then the fixed factors are more intensively and effectively utilised i.e., the efficiency of the fixed factors increases as additional units of the variable factors are added to them. This causes the production to increase at a rapid rate. For example, if a machine can be efficiently operated when four persons are working on it and if in the beginning we are operating it only with three persons, production is bound to increase if the fourth person is also put to work on the machine since the machine will be effectively utilised to its optimum. This happens because, in the beginning some amount of fixed factor remained unutilised and, therefore, when the variable factor is increased, fuller utilisation of the fixed factor becomes possible and it results in increasing returns. A question arises as to why the fixed factor is not initially taken in a quantity which suits the available quantity of the variable factor. The answer is that, generally those factors are taken as fixed which are indivisible. Indivisibility of a factor means that due to technological requirements, a minimum amount of that factor must be employed whatever the level of output. Thus, as more units of the variable factor are employed to work with an indivisible fixed factor, output greatly increases due to fuller utilisation of the latter. The second reason why we get increasing returns



at the initial stage is that as more units of the variable factors are employed, the efficiency of the variable factors itself increases. This is because with sufficient quantity of the variable factor introduction of division of labour and specialisation becomes possible which results in higher productivity.

Stage 2 : Law of diminishing returns : In stage 2, the total product continues to increase at a diminishing rate until it reaches its maximum point H, where the second stage ends. In this stage, both marginal product and average product of the variable factor are diminishing but are positive. At the end of this stage i.e., at point M (corresponding to the highest point H of the total product curve), the marginal product of the variable factor is zero. Stage 2, is known as the stage of diminishing returns because both the average and marginal products of the variable factors continuously fall during this stage. This stage is very important because the firm will seek to produce in its range.

Explanation of the law : The question arises as to why do we get diminishing returns after a certain amount of the variable factor has been added to the fixed quantity of that factor. As explained above, increasing returns occur primarily because of the more efficient use of fixed factors as more units of the variable factor are combined to work with it. Once the point is reached at which the amount of variable factor is sufficient to ensure efficient utilisation of the fixed factor, any further increases in the variable factor will cause marginal and average product to decline because the fixed factor then becomes inadequate relative to the quantity of the variable factor. Continuing the above example, when four men were put to work on one machine, the optimum combination was achieved. Now, if the fifth person is put on the machine, his contribution will be nil. In other words, the marginal productivity will start diminishing. The phenomenon of diminishing returns, like that of increasing returns, rests upon the indivisibility of the fixed factor. Just as the average product of the variable factor increases in the first stage when better utilisation of the fixed indivisible factor is being made, so the average product of the variable factor diminishes in the second stage when the fixed indivisible factor is being worked too hard. Another reason offered for the operation of the law of diminishing returns is the imperfect substitutability of one factor for another. Had the perfect substitute of the scarce fixed factor been available, then the paucity of the scarce fixed factor during the second stage would have been made up by increasing the supply of its perfect substitute with the result that output could be expanded without diminishing returns.

Stage 3 : Law of negative returns : In Stage 3, total product declines, MP is negative, average product is diminishing. This stage is called the stage of negative returns since the marginal product of the variable factor is negative during this stage.

Explanation the law : As the amount of the variable factor continues to be increased to a constant quantity of the other, a stage is reached when the total product declines and marginal product becomes negative. This is due to the fact that the quantity of the variable factor becomes too excessive relative to the fixed factor so that they get in each other's ways with the result that the total output falls instead of rising. In such a situation, a reduction in the units of the variable factor will increase the total output.

Stage of Operation : An important question is in which stage a rational producer will seek to produce. A rational producer will never produce in stage 3 where marginal product of the variable factor is negative. This being so a producer can always increase his output by reducing

the amount of variable factor. Even if the variable factor is free of cost, a rational producer stops before the beginning of the third stage.

A rational producer will also not produce in stage 1 as he will not be making the best use of the fixed factors and he will not be utilising fully the opportunities of increasing production by increasing, the quantity of the variable factor whose average product continues to rise throughout stage 1. Even if the fixed factor is free of cost in this stage, a rational entrepreneur will continue adding more variable factors.

It is thus clear that a rational producer will never produce in stage 1 and stage 3. These stages are called stages of economic absurdity or economic non-sense.

A rational producer will always produce in stage 2 where both the marginal product and average product of the variable factors are diminishing. At which particular point in this stage, the producer will decide to produce depends upon the prices of factors.

1.2.2 Returns to Scale : We shall now undertake the study of production in the long run. Or, we will study changes in output when all factors of production in a particular production function are increased together. In other words, we shall study the behaviour of output in response to a change in the scale. A change in scale means that all factors of production are increased or decreased in the same proportion. Changes in scale is different from changes in factor proportions. Changes in output as a result of the variation in factor proportions, as seen before, form the subject matter of the law of variable proportions. On the other hand, the study of changes in output as a consequence of changes in scale forms the subject matter of returns to scale which is discussed here.

Returns to scale may be constant, increasing or decreasing. If we increase all factors i.e., scale in a given proportion and output increases in the same proportion, returns to scale are said to be constant. Thus, if a doubling or trebling of all factors causes a doubling or trebling of output, returns to scale are constant. But, if the increase in all factors leads to more than proportionate increase in output, returns to scale are said to be increasing. Thus, if all factors are doubled and output increases more than a double, then the returns to scale are said to be increasing. On the other hand, if the increase in all factors leads to less than proportionate increase in output, returns to scale are decreasing. It is needless to say that this law operates in the long run when all the factors can be changed in the same proportion simultaneously.

Constant returns to scale : As stated above, constant returns to scale means that with the increase in the scale in some proportion, output increases in the same proportion. It has been found that production function for the economy as a whole corresponds to production function exhibiting constant returns to scale. Also, it has been found that an individual firm passes through a long phase of constant returns to scale in its lifetime.

Constant return to scale is otherwise called as “Linear Homogeneous Production Function”

Increasing returns to scale : As stated earlier, increasing returns to scale means that output increases in a greater proportion than the increase in inputs. When a firm expands, increasing returns to scale are obtained in the beginning. For example, a wooden box of 3 ft. cube contains 9 times greater wood than the wooden box of 1 foot-cube. But the capacity of the 3 foot- cube



box is 27 times greater than that of the one foot cube. Many such examples are found in the real world. Another reason for increasing returns to scale is the indivisibility of factors. Some factors are available in large and lumpy units and can, therefore, be utilised with utmost efficiency at a large output. If all the factors are perfectly divisible, increasing returns may not occur. Returns to scale may also increase because of greater possibilities of specialisation of land and machinery.

Decreasing returns to scale : When output increases in a smaller proportion with an increase in all inputs, decreasing returns to scale are said to prevail. When a firm goes on expanding by increasing all inputs, diminishing returns to scale set in. Decreasing returns to scale eventually occur because of increasing difficulties of management, coordination and control. When the firm has expanded to a very large size, it is difficult to manage it with the same efficiency as before.

The Cobb-Douglas production function, explained earlier is used to exhibit “returns to scale” in production:

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).

$a + b = 1$ Constant returns to scale result i.e. the output increases in the same proportion in which factors are increased.

$a + b < 1$ decreasing returns to scale result i.e. the output increases less than the proportionate increase in the labour and capital.

1.3 PRODUCTION OPTIMISATION

Normally, a firm is interested to know what combination of factors of production (or inputs) would minimise its cost of production. This can be known with the help of isoquants and iso-cost lines.

Isoquants: Isoquants are similar to indifference curves of the theory of consumer behaviour. An isoquant represents all those combinations of inputs which are capable of producing the same level of output. Isoquants are also called equal-product or iso-product curves. Since an equal-product curve represents all those combination of inputs which yield an equal quantity of output, the producer is indifferent between them. Therefore, another name for an isoquant is production-indifference curve. The concept of isoquant can be easily understood with the help of the following schedule.

Table 2 : Various combinations of X and Y to produce a given level of output

Factor combination	Factor X	Factor Y
A	1	12
B	2	08
C	3	05
D	4	03
E	5	02

When we plot them, we get a curve IQ as shown in Figure 2.

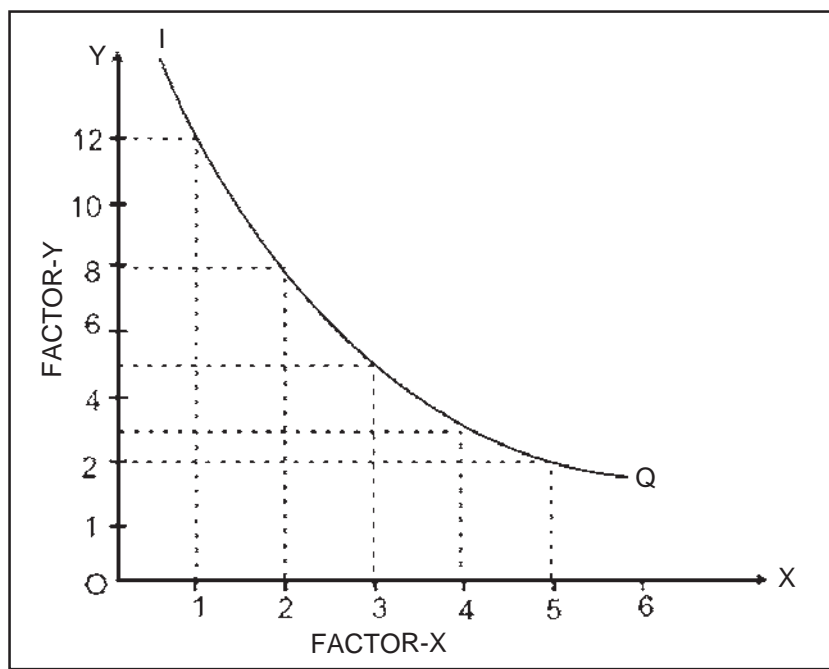


Fig. 2 : Equal Product Curve or Isoquant

Isoquants have properties similar to indifference curves, but there is one important difference between the two: whereas in an indifference curve it is not possible to quantify the level of satisfaction acquired by the consumer, the level of production acquired by the producer is easily quantified. Thus, while isoquant IQ1 represents 100 units, curves IQ2, IQ3 etc. representing higher levels of production can be drawn. While a curve on the right represents a higher level of output, that on the left represents a lower level of output.

Iso-cost or Equal-cost Lines: Iso-cost line represents the prices of factors. It shows various combinations of two factors which the firm can buy with given outlay. Suppose a firm has Rs. 1,000 to spend on the two factors X and Y. If the price of factor X is Rs. 10 and that of Y is Rs. 20, the firm can spend its outlay on X and Y in various ways. It can spend the entire amount on X and thus buy 100 units of X and zero units of Y or it can spend the entire outlay on Y and buy 50 units of it with zero units of X factor. In between, it can have any combination of X and Y.

We can show iso-cost line diagrammatically also. The X-axis shows the units of factor X and Y-axis the units of factor Y. When entire Rs. 1,000 are spent on factor X we get OB and when entire amount is spent on factor Y we get OA. The straight line AB which joins points A and B will pass through all combinations of factors X and Y which the firm can buy with outlay of Rs. 1,000. The line AB is called iso-cost line.

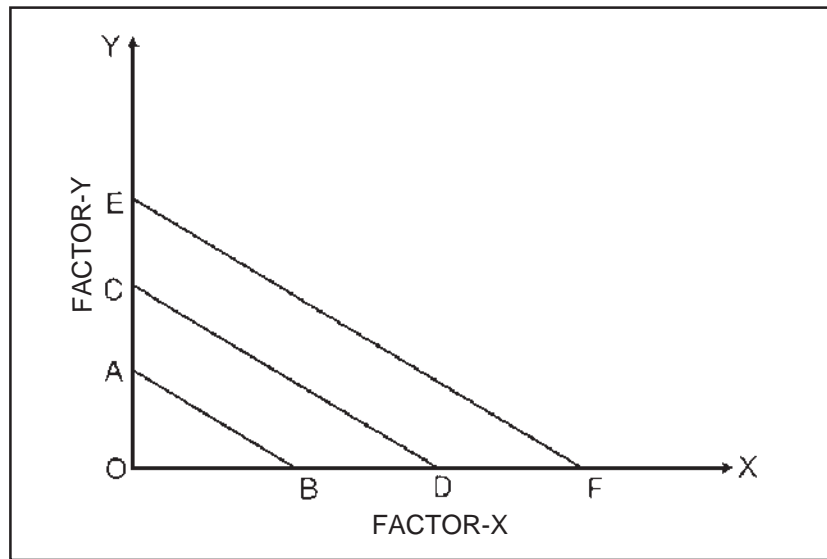


Fig. 3 : Iso-cost lines

Figure 3 shows various iso-cost lines representing different combinations of factors with different outlays. Iso-quants, which represent the technical conditions of production for a product and iso-cost lines which represent various 'levels of cost or outlay' (given the prices of two factors) can help the firm to optimize its production. It may try to minimise its cost for producing a given level of output or it may try to maximise the output for a given cost or outlay. Suppose the firm has already decided about the level of output to be produced. Then the question is with which factor combination the firm should try to produce the pre-decided level of output. The firm will try to use the least-cost combination of factors. The least cost combination of factors can be found by super-imposing iso-quant on iso-cost lines. This is shown in Figure 4

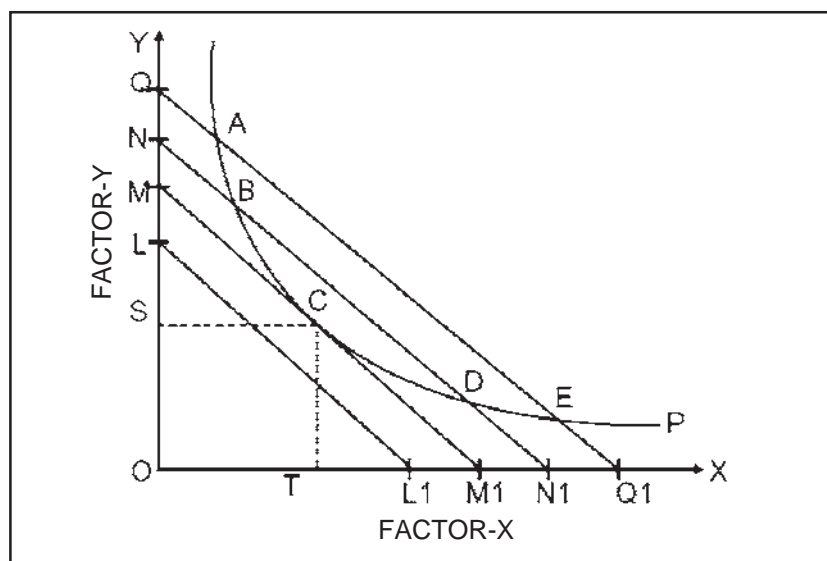


Fig. 4 : Least-cost Combination of Factors: Producer's Equilibrium

Suppose the firm has decided to produce 1,000 units (represented by iso-quant P). These units can be produced by any factor combination lying on P such as A, B, C, D, E, etc. The cost of producing 1,000 units would be minimum at the factor combination represented by point C where the iso-cost line MM1 is tangent to the given isoquant P. At all other points such as A, B, D, E the cost is more as these points lie on higher iso-cost lines than MM1. Thus, the factor combination represented by point C is the optimum combination for the producer. It represents the least-cost of producing 1,000 units of output. It is thus clear that the tangency point of the given isoquant with an iso-cost line represents the least cost combination of factors for producing a given output.

1.4 ECONOMIES AND DISECONOMIES OF SCALE

The Scale of Production

In the modern days, the size of business undertakings has greatly increased and production on a large scale is a very important feature of modern industrial society. Large-scale production offers certain advantages which help in reducing the cost of production. Economies arising out of large-scale production can be grouped into two categories; viz., internal economies and external economies. Internal economies are those economies of production which accrue to the firm when it expands the output, so that the cost of production would come down considerably and place the firm in a better position to compete in the market effectively. Economies arise purely due to endogenous factors relating to efficiency of the entrepreneur or his managerial talents or the type of machinery used or the marketing strategy adopted. These economies arise within the firm and help the firm only. On the other hand, external economies are the benefits accruing to each member firm of the industry as a result of the expansion of the industry.

Internal Economies and Diseconomies : We saw that returns to scale increase in the initial stages and after remaining constant for a while, they decrease. The question arises as to why we get increasing returns to scale due to which cost falls and why after a certain point we get decreasing returns to scale due to which cost rises. The answer is that initially a firm enjoys internal economies of scale and beyond a certain limit it suffers from internal diseconomies of scale. Internal economies and diseconomies are of the following main kinds :

- (i) **Technical economies and diseconomies :** Large-scale production is associated with technical economies. As the firm increases its scale of operations, it becomes possible to use more specialised and efficient form of all factors, specially capital equipment and machinery. For producing higher levels of output, there is generally available a more efficient machinery which when employed to produce a large output yields a lower cost per unit of output. Secondly, when the scale of production is increased and the amount of labour and other factors become larger, introduction of a greater degree of division of labour and specialisation becomes possible and as a result cost per unit declines.

However, beyond a certain point, a firm experiences net diseconomies of scale. This happens because when the firm has reached a size large enough to allow utilisation of almost all the possibilities of division of labour and the employment of more efficient machinery, further increase in the size of the plant will bring high long-run cost because of difficulties of management. When the scale of operations becomes too large, it becomes difficult for the management to exercise control and to bring about proper coordination.



- (ii) **Managerial economies and diseconomies** : Managerial economies refer to reduction in managerial cost. When output increases, division of labour can be applied to management. The production manager can look after production, sales manager can look after sales, finance manager can look after the finance department. If the scale of production increases further, each department can be further sub-divided for e.g. sales can be split into sections for advertising exports and customer service.

Since individual activities come under the supervision of specialists, management's efficiency and productivity will greatly improve. Decentralisation of decision making also becomes possible in such a firm which enhances further the efficiency and productivity of managers. Thus, specialisation of management enables large firms to achieve reduction in managerial costs.

However, as the scale of production increases beyond a certain limit, managerial diseconomies set in. Management finds it difficult to exercise control and to bring in coordination among various departments. The managerial structure becomes more complex and is affected by more bureaucracy, more red tape, lengthening of communication lines and so on. All these affect the efficiency and productivity of management and the firm itself.

- (iii) **Commercial economies and diseconomies** : Production of large volumes of goods requires large amount of materials and components. This enables the firm to place bulk order for materials and components and to enjoy lower prices for them. Economies can also be achieved in selling the product. If the sales staff are not being worked to capacity, additional output can be sold at little extra cost. Moreover, large firms can benefit from economies of advertising. As the scale of production increases, advertising costs per unit of output fall. In addition, a large firm may also be able to sell its by-products; something which might be unprofitable for a small firm.

These economies become diseconomies after an optimum scale. For example, advertisement expenditure and other marketing overheads will increase more than proportionately after the optimum scale.

- (iv) **Financial economies and diseconomies** : In raising finance for expansion, a large firm is in favourable position. It can, for instance, offer better security to bankers and, because it is well-known, raise money at lower cost, since investors have confidence in it and prefer shares which can be readily sold on the stock exchange.

However, these financial costs will rise more than proportionately after the optimum scale of production. This may happen because of relatively more dependence on external finances.

- (v) **Risk bearing economies and diseconomies** : It is said that a large business with diverse and multi-production capability is in a better position to withstand economic ups and downs, and therefore, enjoys economies of risk bearing.

However, risk may increase if diversification, instead of giving a cover to economic disturbances, increases these.

External Economies and Diseconomies : The use of greater degree of division of labour and specialised machinery at higher levels of output are termed as internal economies. They are internal in the sense that they accrue to the firm due to its own efforts. Besides internal economies, there are external economies which are very important for a firm. External economies and diseconomies are those economies and diseconomies which accrue to firms as a result of expansion in the output of whole industry and they are not dependent on the output level of individual firms. They are external in the sense that they accrue to firms not out of their internal situation but from outside i.e. expansion of the industry. These are available to one or more of the firms in the form of :

1. ***Cheaper raw materials and capital equipment :*** The expansion of an industry may result in exploration of new and cheaper sources of raw material, machinery and other types of capital equipments. Expansion of an industry results in greater demand for the various kinds of materials and capital equipments required by it. This makes it possible to purchase on a large scale from other industries. This reduces their cost of production and hence their prices. Thus, firms using these materials and capital equipments will be able to get them at a lower price.
2. ***Technological external economies :*** When the whole industry expands, it may result in the discovery of new technical knowledge and in accordance with that, the use of improved and better machinery than before. This will change the technical co-efficients of production and will enhance productivity of firms in the industry and reduce their cost of production.
3. ***Development of skilled labour :*** When an industry expands in an area, the labour in that area is well accustomed to do the various productive processes and learns a good deal from experience. As a result, with the growth of an industry in an area, a pool of trained labour is developed which has a favourable effect on the level of productivity and cost of the firms in that industry.
4. ***Growth of ancillary industries :*** With the growth of an industry, a number of ancillary industries may specialise in the production of raw materials, tools, machinery, etc. They can provide them at a lower price to the main industry. Likewise, some firms may get developed for processing the waste products of the industry and for making some useful products out of it. This will tend to reduce the cost of production in general.
5. ***Better transportation and marketing facilities :*** The expansion of an industry resulting from entry of new firms may make possible the development of transportation and marketing network to a great extent and these will greatly reduce the cost of production of the firms. Similarly, communication systems may get modernised resulting in better and speedy information.

However, external economies may also cease if there are certain disadvantages which may neutralise the advantages of the expansion of an industry. We call them external diseconomies. An example of external diseconomies is the rise in some factor prices. When an industry expands, the requirement of various factors of production increases; for example, that of raw materials, capital goods, skilled labour and so on. This may result in pushing up the prices of such factors of productions, especially when they are short in supply. Moreover, too many firms in an industry at one place may also result in higher transportation cost, marketing cost and high pollution control cost. The government may also through its locational policy, prohibit or restrict expansion of an industry at a particular place.



SUMMARY

- Production is one of the basic economic activities. In simple terms production, means 'creation of utility'. It is the outcome of the combined activity of the four factors of production viz, land, labour, capital and organization.
- Land includes all those natural resources whose supply for the economy as a whole is fixed.
- Labour is any mental or physical exertion directed to produce goods or services.
- Capital is produced means of production and it comprises man made machines and materials which are used for further production.
- Entrepreneur is the person who bears the risk and uncertainties of business.
- Factors of production can be divided into two categories – Fixed factors are those factors whose quantity remains unchanged and variable factors change with a change in the level of output.
- Production function is a technical relationship between inputs and output. Samuelson describes production function as the relationship between the maximum amount of output that can be produced and the input required to make that output. It is defined for a given state of technology.
- Law of variable proportion or law of diminishing returns is relevant when some factors are kept fixed and others are varied. It is applicable for the short-run.
- There are three stages of the law of variable proportion – law of increasing returns, law of diminishing returns and law of negative returns.
- Total product is the total output resulting from the efforts of all the factors of production combined together at any time.
- Marginal product is the change in total product per unit change in the quantity of variable factor.
- Average product is the total product per unit of the variable factor.
- Law of returns to scale describes the relationship between inputs and output in the long run when all inputs are changed in the same proportion.
- Returns to scale may be constant, increasing and decreasing.
- Constant returns to scale occur when the inputs increase by some proportion and the output also increases by the same proportion. It is also called linear homogeneous production function.
- Increasing returns to scale occur when the inputs increase by some proportion and the output increases more than proportionately
- Decreasing returns to scale occur when the inputs increase by some proportion and the output increases less than proportionately

- Returns to scale occurs due to economies of scale. Economies of scale are of two kinds- external economies of scale and internal economies of scale.
- External economies of scale accrue to a firm due to factors which are external to it.
- Internal economies of scale accrue to a firm when it engages in large scale production. Increase in scale, beyond the optimum level, results in diseconomies of scale.
- Isoquants are producer's indifference curves. They show all those combinations of different factors of production which give the same output to the producer.
- Iso-cost lines show various combinations of two factors which the firm can buy with given expenditure or outlay.
- By combining Isoquants and Iso-cost Lines, a producer can find out the combination of factors of production which is optimum i.e. that combination of factors of production which would minimise his cost of production.
- For producing the given output, the tangency point of the relevant isoquant (representing the output) with an iso-cost line represents the least cost combination of factors.



CHAPTER – 3

THEORY OF PRODUCTION AND COST

Unit 2

Theory
of
Cost

Learning Objectives

At the end of this unit, you will be able to :

- ◆ understand the meaning of cost and various concepts of cost.
- ◆ understand cost function in the short run and in the long run.

2.0 COST ANALYSIS

Cost analysis refers to the study of behaviour of cost in relation to one or more production criteria, namely, size of output, scale of operations, prices of factors of production and other relevant economic variables. In other words, cost analysis is concerned with financial aspects of production relations as against physical aspects which were considered in production analysis. In order to have a clear understanding of the cost function, it is important to understand various concepts of costs.

2.1 COST CONCEPTS

Accounting costs and economic costs : When an entrepreneur undertakes an act of production he has to pay prices for the factors which he employs for production. He thus pays, wages to workers employed, prices for the raw materials, fuel and power used, rent for the building he hires, and interest on the money borrowed for doing business. All these are included in his cost of production and are termed as accounting costs. Thus, accounting costs take care of all the payments and charges made by the entrepreneur to the suppliers of various productive factors.

But it generally happens that an entrepreneur invests a certain amount of capital in his business. If the capital invested by the entrepreneur in his business had been invested elsewhere, it would have earned certain amount of interest or dividend. Moreover, an entrepreneur devotes time to his own work of production and contributes his entrepreneurial and managerial ability to do business. Had he not set up his own business, he would have sold his services to others for some positive amount of money. Accounting costs do not include these costs. These costs form part of economic cost. Thus, economic costs include : (1) the normal return on money capital invested by the entrepreneur himself in his own business; (2) the wages or salary not paid to the entrepreneur, but could have been earned if the services had been sold somewhere else. Likewise, the monetary reward for all factors owned by the entrepreneur himself and employed by him in his own business are also considered a part of economic costs. Thus, accounting costs relate to those costs only which involve cash payments by the entrepreneur of the firm. Economic costs take into account these accounting costs; in addition, they also take into account the amount of money the entrepreneur could have earned if he had invested his money and sold his own services and other factors in the next best alternative uses. Accounting costs are also called explicit costs whereas the cost of factors owned by the entrepreneur himself and employed in his own business are called implicit costs. Thus, economic costs include both accounting costs and implicit costs. The concept of economic cost is important because an entrepreneur must cover his economic cost if he wants to earn normal profits and abnormal profits are over and above these normal profits. In other words, an entrepreneur is said to be



earning profits (abnormal) only when his revenues are able to cover not only his explicit costs but also implicit costs.

Outlay costs and opportunity costs : Outlay costs involve actual expenditure of funds on, say, wages, materials, rent, interest, etc. Opportunity cost, on the other hand, is concerned with the cost of foregone opportunity; it involves a comparison between the policy that was chosen and the policy that was rejected. For example, the opportunity cost of using capital is the interest that it can earn in the next best use with equal risk.

A distinction between outlay costs and opportunity costs can be drawn on the basis of the nature of the sacrifice. Outlay costs involve financial expenditure at some time and hence are recorded in the books of account. Opportunity costs relate to sacrificed alternatives; they are, in general not recorded in the books of account.

The opportunity cost concept is generally very useful, e.g., in a cloth mill which spins its own yarn, the opportunity cost of yarn to the weaving department is the price at which the yarn could be sold. This has to be considered while measuring profitability of the weaving operations.

In long-term cost calculations also it is a useful concept e.g., while calculating the cost of higher education, it is not the tuition fee and cost of books alone that are relevant. One should also take into account the earnings foregone in order to attend classes.

Direct or traceable costs and indirect or non-traceable costs; Direct costs are costs that are readily identified and are traceable to a particular product, operation or plant. Even overhead costs can be direct as to a department; manufacturing costs can be direct to a product line, sales territory, customer class etc. We must know the purpose of cost calculation before considering whether a cost is direct or indirect.

Indirect costs are not readily identified nor visibly traceable to specific goods, services, operations, etc. but are nevertheless charged to the jobs or products in standard accounting practice. The economic importance of these costs is that these, even though not directly traceable to a product, may bear some functional relationship to production and may vary with output in some definite way. Examples of such costs are electric power and common costs incurred for general operation of business benefiting all products jointly.

Fixed and variable costs : Fixed or constant costs are not a function of output; they do not vary with output upto a certain level of activity. These costs require a fixed expenditure of funds irrespective of the level of output, e.g., rent, property taxes, interest on loans and depreciation when taken as a function of time and not of output. However, these costs vary with the size of the plant and are a function of capacity. Therefore, fixed costs do not vary with the volume of output within a capacity level.

Fixed costs cannot be avoided. These costs are fixed so long as operations are going on. They can be avoided only when operations are completely closed down. We can call them as inescapable or uncontrollable costs. But, there are some costs which will continue even after the operations are suspended, as for example, for storing of old machines which cannot be sold in the market. Some of the fixed costs such as costs of advertising, etc. are programmed fixed costs or discretionary expenses, because they depend upon the discretion of management whether to spend on these services or not.

Variable costs are costs that are a function of output in the production period. For example, wages and cost of raw materials are variable costs. Variable costs vary directly and sometimes proportionately with output. Over certain ranges of production, they may vary less or more than proportionately depending on the utilization of fixed facilities and resources during the production process.

2.2 COST FUNCTION

The cost function refers to the mathematical relation between cost of a product and the various determinants of costs. In a cost function, the dependent variable is unit cost or total cost and the independent variables are the price of a factor, the size of the output or any other relevant phenomenon which has a bearing on cost, such as technology, level of capacity utilization, efficiency and time period under consideration. Cost function is a function which is obtained from production function and the market supply of inputs. It expresses the relationship between costs and output. Cost functions are of two kinds: They are Short-run cost functions and long-run cost functions.

2.3 SHORT RUN TOTAL COSTS

Total, fixed and variable costs : There are some factors which can be easily adjusted with changes in the level of output. A firm can readily employ more workers if it has to increase output. Similarly, it can purchase more raw materials if it has to expand production. Such factors which can be easily varied with a change in the level of output are called variable factors. On the other hand, there are some factors such as building, capital equipment, or top management team which cannot be so easily varied. It requires comparatively longer time to make changes in them. It takes time to install a new machinery. Similarly, it takes time to build a new factory. Such factors which cannot be readily varied and require a longer period to adjust are called fixed factors. Corresponding to the distinction between variable and fixed factors we distinguish between short run and long run periods of time. Short run is a period of time in which output can be increased or decreased by changing only the amount of variable factors, such as labour, raw material, etc. In the short run, quantities of fixed factors cannot be varied in accordance with changes in output. If the firm wants to increase output in the short run, it can do so only with the help of variable factors, i.e., by using more labour and/or by buying more raw material. Thus, short run is a period of time in which only variable factors can be varied, while the quantities of fixed factors remain unaltered. On the other hand, long run is a period of time in which the quantities of all factors may be varied. Thus all factors become variable in the long run.

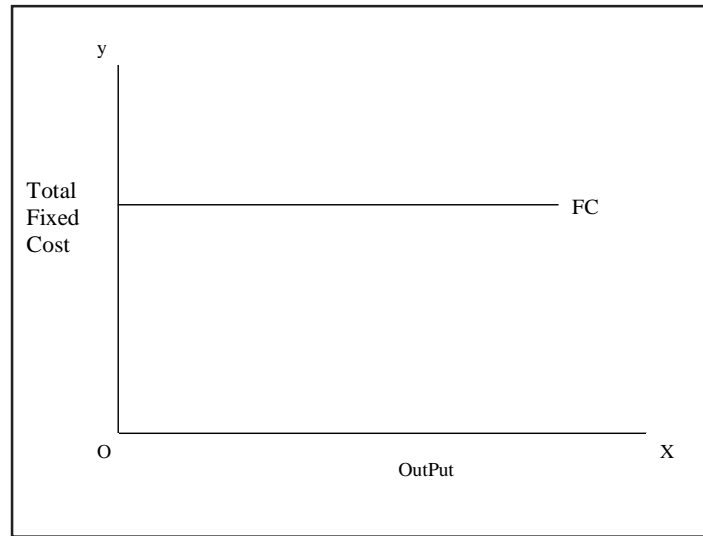


Fig. 5 : Completely Fixed Cost

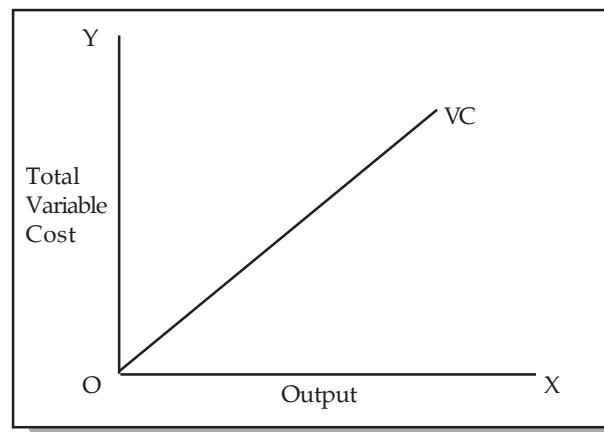


Fig. 6 : Completely Variable Cost

Thus, we find that fixed costs are those costs which are independent of output, i.e., they do not change with changes in output. These costs are a “fixed amount” which are incurred by a firm in the short run, whether the output is small or large. Even if the firm closes down for some time in the short run but remains in business, these costs have to be borne by it. Fixed costs include such charges as contractual rent, insurance fee, maintenance cost, property taxes, interest on capital employed, manager’s salary, watchman’s wages etc. Variable costs, on the other hand are those costs which change with changes in output. These costs include payments such as wages of labour employed, prices of raw material, fuel and power used, transportation cost etc. If a firm shuts down for a short period, then it may not use the variable factors of production and will not therefore incur any variable cost.

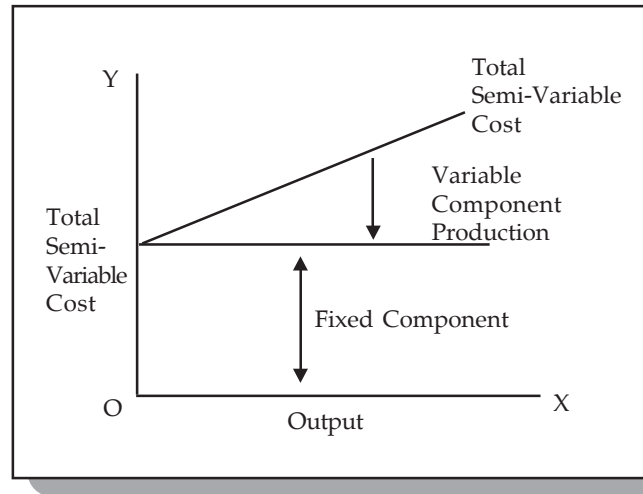


Fig. 7 : Semi Variable Cost

There are some costs which are neither perfectly variable, nor absolutely fixed in relation to the changes in the size of output. They are known as semi-variable costs. Example: Electricity charges include both a fixed charge and a charge based on consumption.

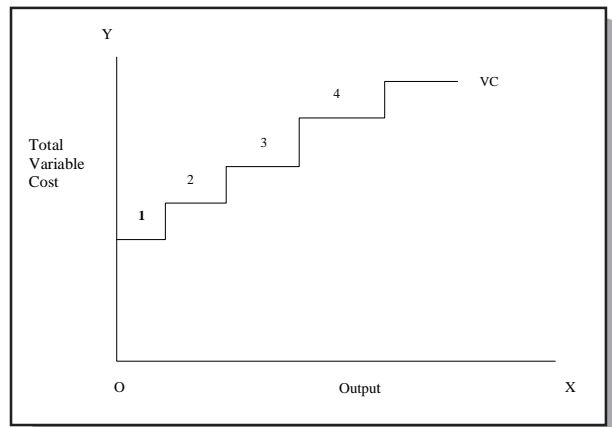


Fig. 8 : A Stair-step Variable Cost

There are some costs which may increase in a stair-step fashion, i.e., they remain fixed over certain range of output; but suddenly jump to a new higher level when output goes beyond a given limit. Eg. Fixed salary of foreman will have a sudden jump if another foreman is appointed when the output crosses a particular limit.

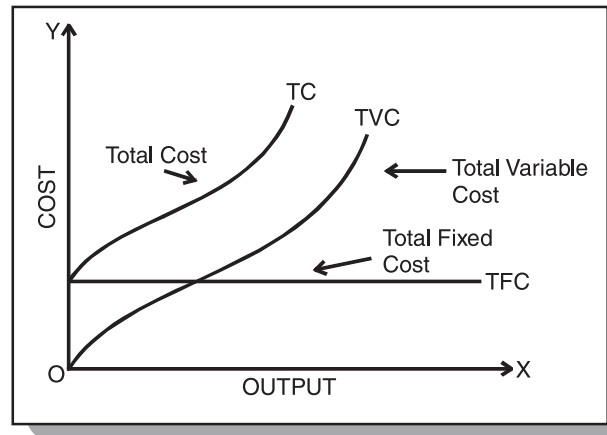


Fig. 9 : Short run Total Cost Curves

Total cost of a business is thus the sum of total variable cost and total fixed cost or symbolically $TC = TFC + TVC$. We may represent total cost, total variable cost and fixed cost diagrammatically.

In the diagram above, the total fixed cost curve (TFC) is parallel to X-axis. This curve starts from a point on the Y-axis meaning thereby that fixed cost will be incurred even if the output is zero. On the other hand the total variable cost curve rises upward showing thereby that as output increases, total variable cost increases. This curve starts from the origin which shows that when the output is zero, variable costs are also nil. The total cost curve has been obtained by adding vertically the total fixed cost curve and the total variable cost curve.

Short run average cost

Average fixed cost (AFC) : AFC is obtained by dividing the total fixed cost by the number of

units of output produced. i.e. $AFC = \frac{TFC}{Q}$ where Q is the number of units produced. Thus,

average fixed cost is the fixed cost per unit of output. For example, if a firm is producing with a total fixed cost of ₹ 2,000/-. When output is 100 units, the average fixed cost will be ₹ 20. And now, if the output increases to 200 units, average fixed cost will be ₹ 10. Since total fixed cost is a constant amount, average fixed cost will steadily fall as output increases. Therefore, if we draw an average fixed cost curve, it will slope downwards throughout its length but will not touch the X-axis as AFC can not be zero. (Fig. 10)

Average variable cost (AVC) : Average variable cost is found out by dividing the total variable

cost by the number of units of output produced, i.e. $AVC = \frac{TVC}{Q}$ where Q is the number of

units produced. Thus average variable cost is variable cost per unit of output. Average variable cost normally falls as output increases from zero to normal capacity output due to occurrence of increasing returns. But beyond the normal capacity output, average variable cost will rise steeply because of the operation of diminishing returns (the concepts of increasing returns and diminishing returns have already been discussed earlier). If we draw an average variable cost curve, it will first fall, then reach a minimum and then rise. (Fig. 10)

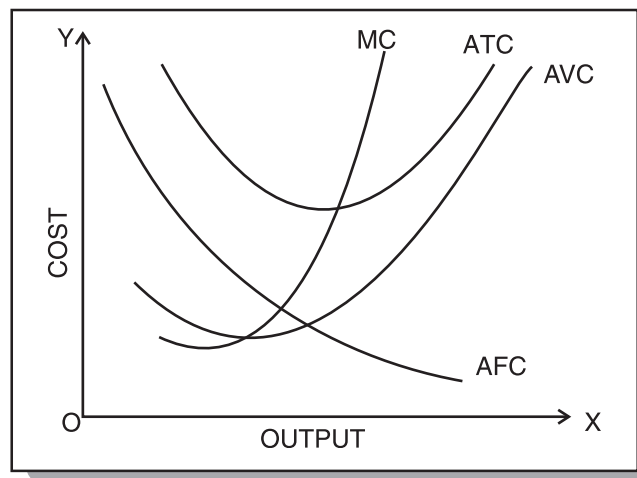


Fig. 10 : Short run Average and Marginal Cost Curves

Average total cost (ATC) : Average total cost is the sum of average variable cost and average fixed cost. i.e., $ATC = AFC + AVC$. It is the total cost divided by the number of units produced. The behaviour of average total cost curve depends upon the behaviour of the average variable cost curve and the average fixed cost curve. In the beginning, both AVC and AFC curves fall, therefore, the ATC curve will also fall sharply. When AVC curve begins to rise, but AFC curve still falls steeply, ATC curve continues to fall. This is because, during this stage, the fall in AFC curve is greater than the rise in the AVC curve, but as output increases further, there is a sharp rise in AVC which more than offsets the fall in AFC. Therefore, ATC curve first falls, reaches its minimum and then rises. Thus, the average total cost curve is a "U" shaped curve. (Fig. 10)

Marginal Cost : Marginal cost is the addition made to the total cost by the production of an additional unit of output. In other words, it is the total cost of producing t units instead of $t-1$ units, where t is any given number. For example, if we are producing 5 units at a cost of ₹ 200 and now suppose the 6th unit is produced and the total cost is ₹ 250, then the marginal cost is ₹ 250 - 200 i.e., ₹ 50. And marginal cost will be ₹ 24, if 10 units are produced at a total cost of ₹ 320 $[(320-200)/(10-5)]$. It is to be noted that marginal cost is independent of fixed cost. This is because fixed costs do not change with output. It is only the variable costs which change with a change in the level of output in the short run. Therefore, marginal cost is in fact due to the changes in variable costs. Symbolically marginal cost can be written as :

$$MC = \frac{\Delta TC}{\Delta Q}$$

ΔTC = Change in Total cost

ΔQ = Change in Output

or

$$MC_n = TC_n - TC_{n-1}$$

Marginal cost curve falls as output increases in the beginning. It starts rising after a certain level of output. This happens because of the influence of the law of variable proportions. The fact that marginal product rises first, reaches a maximum and then declines ensures that the



marginal cost curve of a firm declines first, reaches its minimum and then rises. In other words marginal cost curve of a firm is “U” shaped (see Figure 10).

The behaviour of these costs has also been shown in Table 2.

Table 2 : Various Costs

<i>Units of output</i>	<i>Total fixed cost</i>	<i>Total variable cost</i>	<i>Total cost</i>	<i>Average fixed cost</i>	<i>Average variable cost</i>	<i>Average total cost</i>	<i>Marginal cost</i>
0	1000	0	1000	-	-	-	-
1	1000	50	1050	1000.0	50.00	1050.0	50
2	1000	90	1090	500.00	45.00	545.00	40
3	1000	140	1140	333.33	46.67	380.00	50
4	1000	196	1196	250.00	49.00	299.00	56
5	1000	255	1255	200.00	51.00	251.00	59
6	1000	325	1325	166.67	54.17	221.83	70
7	1000	400	1400	142.86	57.14	200.00	75
8	1000	480	1480	125.00	60.00	185.00	80
9	1000	570	1570	111.11	63.33	174.44	90
10	1000	670	1670	100.00	67.00	167.00	100
11	1000	780	1780	90.91	70.91	161.82	110
12	1000	1080	2080	83.33	90.00	173.33	300

The above table shows that :

- (i) Fixed cost does not change with increase in output upto a given level. Average fixed cost, therefore, comes down with every increase in output.
- (ii) Variable cost increases, but not necessarily in the same proportion as the increase in output. In the above case, average variable cost comes down gradually till 4 units are produced. Thereafter it start increasing.
- (iii) Marginal cost is the additional cost divided by the additional units produced. This also comes down first and then start increasing.

Relationship between Average Cost and Marginal Cost : The relationship between marginal cost and average cost is the same as that between any other marginal-average quantities. The following are the points of relationship between the two.

- (1) When average cost falls as a result of an increase in output, marginal cost is less than average cost.
- (2) When average cost rises as a result of an increase in output, marginal cost is more than average cost.
- (3) When average cost is minimum, marginal cost is equal to the average cost. In other words, marginal cost curve cuts average cost curve at its minimum point (i.e. optimum point).

Figure 10 confirms the above points of relationship.

2.4 LONG RUN AVERAGE COST CURVE

As stated above, long run is a period of time during which the firm can vary all of its inputs - unlike short run in which some inputs are fixed and others are variable. In other words, whereas in the short run the firm is tied with a given plant, in the long run the firm moves from one plant to another; it can acquire a big plant if it wants to increase its output and a small plant if it wants to reduce its output. Long run cost of production is the least possible cost of producing any given level of output when all individual factors are variable. A long run cost curve depicts the functional relationship between output and the long run cost of production.

In order to understand how the long run average cost curve is derived, we consider three short run average cost curves as shown in Figure 11. These short run cost curves (SACs) are also called plant curves. In the short run the firm can be operating on any short run average cost curve given the size of the plant. Suppose that these are the only three plants which are technically possible. Given the size of the plant, the firm will be increasing or decreasing its output by changing the amount of the variable inputs. But in the long run, the firm chooses among the three possible sizes of plants as depicted by short run average curve (SAC_1 , SAC_2 , SAC_3). In the long run, the firm will examine with which size of plants or on which short run average cost curve it should operate to produce a given level of output, so that the total cost is minimum. It will be seen from the diagram that upto OB amount of output, the firm will operate on the SAC_1 , though it could also produce with SAC_2 . Upto OB amount of output, the production on SAC_1 results in lower cost than on SAC_2 . For example, if the level of output OA is produced with SAC_1 , it will cost AL per unit and if it is produced with SAC_2 it will cost AH and we can see that AH is more than AL . Similarly, if the firm plans to produce an output which is larger than OB but less than OD , then it will not be economical to produce on SAC_1 . For this, the firm will have to use SAC_2 . Similarly, the firm will use SAC_3 for output larger than OD . It is thus clear that, in the long run, the firm has a choice in the employment of plant and it will employ that plant which yields minimum possible unit cost for producing a given output.

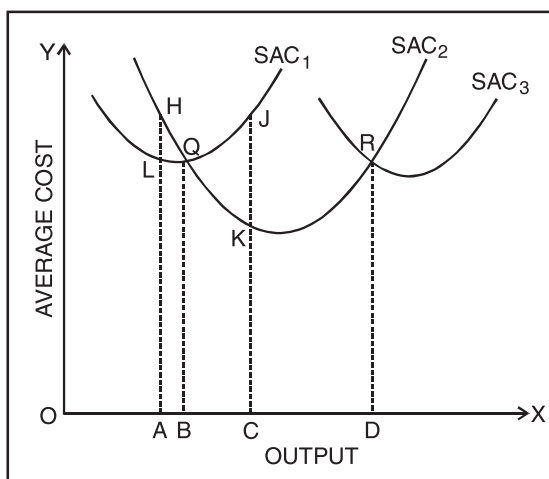


Fig. 11 : Short run Average Cost Curves

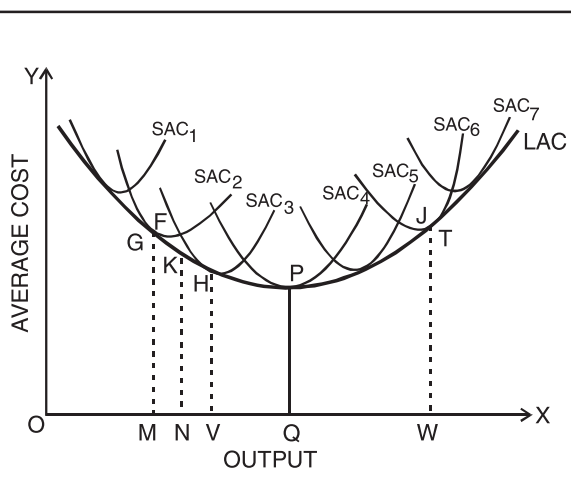


Fig. 12 : Long run Average Cost Curves



Suppose, the firm has a choice so that a plant can be varied by infinitely small gradations so that there are infinite number of plants corresponding to which there are numerous average cost curves. In such a case the long run average cost curve will be a smooth curve enveloping all these short run average cost curves.

As shown in Figure 12, the long run average cost curve is so drawn as to be tangent to each of the short run average cost curves. Every point on the long run average cost curve will be a tangency point with some short run AC curve. If a firm desires to produce any particular output, it then builds a corresponding plant and operates on the corresponding short run average cost curve. As shown in the figure, for producing OM, the corresponding point on the LAC curve is G and the short run average cost curve SAC_2 is tangent to the long run AC at this point. Thus, if a firm desires to produce output OM, the firm will construct a plant corresponding to SAC_2 and will operate on this curve at point G. Similarly, the firm will produce other levels of output choosing the plant which suits its requirements of lowest possible cost of production. It is clear from the figure that larger output can be produced at the lowest cost with larger plant whereas smaller output can be produced at the lowest cost with smaller plants. For example, to produce OM, the firm will be using SAC_2 only; if it uses SAC_3 , it will result in higher unit cost than SAC_2 . But, larger output OV can be produced most economically with a larger plant represented by the SAC_3 . If we produce OV with a smaller plant, it will result in higher cost per unit. Similarly, if we produce larger output with a smaller plant it will involve higher costs because of its limited capacity.

It is to be noted that LAC curve is not tangent to the minimum points of the SAC curves. When the LAC curve is declining, it is tangent to the falling portions of the short run cost curves and when the LAC curve is rising, it is tangent to the rising portions of the short run cost curves. Thus for producing output less than "OQ" at the lowest possible unit cost, the firm will construct the relevant plant and operate it at less than its full capacity, i.e., at less than its minimum average cost of production. On the other hand, for outputs larger than OQ the firm will construct a plant and operate it beyond its optimum capacity. "OQ" is the optimum output. This is because "OQ" is being produced at the minimum point of LAC and corresponding SAC i.e., SAC_4 . Other plants are either used at less than their full capacity or more than their full capacity. Only SAC_4 is being operated at the minimum point.

Long run average cost curve is often called a planning curve because a firm plans to produce any output in the long run by choosing a plant on the long run average cost curve corresponding to the given output. The long run average cost curve helps the firm in the choice of the size of the plant for producing a specific output at the least possible cost.

Explanation of the "U" shape of the long run average cost curve : As has been seen in the diagram LAC curve is a "U" shaped curve. This shape of LAC curve depends upon the returns to scale. As discussed earlier, as the firm expands, returns to scale increase. After a range of constant returns to scale, the returns to scale finally decrease. On the same line, the LAC curve first declines and then finally rises. Increasing returns to scale cause fall in the long run average cost and decreasing returns to scale result in rise in long run average cost. Falling long run average cost and increasing economies of scale result from internal and external economies of scale and rising long run average cost and diminishing returns to scale result from internal and external diseconomies of scale (economies of scale have been discussed earlier at the relevant place).

The long run average cost curve initially falls with increase in output and after a certain point it rises making a boat shape. Long-run Average cost (LAC) curve is also called the planning curve of the firm as it helps in choosing an appropriate a plant on the decided level of output. The long-run average cost curve is also called "Envelope curve", because it envelopes or supports a family of short run average cost curves from below.

The above figure depicting long-run average cost curve is arrived at on the basis of traditional economic analysis. It is flattened 'U' shaped. This type of curve could exist only when the state of technology remains constant. But, the empirical evidence shows that the state of technology changes in the long-run.

Therefore, modern firms face 'L-shaped' cost curve than 'u-shaped'. The L shaped cost curve is given below. According to the diagram, over AB range, the curve is perfectly flat. Over this range all sizes of plant have the same minimum cost.

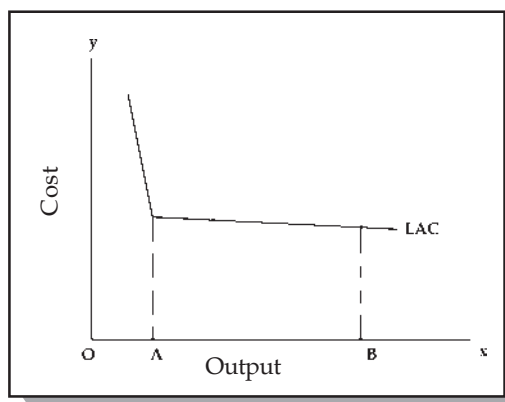


Fig. 13 : Long-run Average Cost Curve

SUMMARY

- The relationship between cost and output is called cost function.
- Cost function of a firm depends upon its production function and the prices of factors of production.
- There are various kinds of cost concepts
 - **Accounting costs:** Costs which are accounted for. It is also called explicit cost.
 - **Economic costs:** Costs which are accounted for plus costs which are not incurred but would have been incurred but for the employment of self services by the entrepreneurs. In other words, it is the sum of implicit and explicit cost.
 - **Outlay cost:** The cost that involves actual expenditure.
 - **Opportunity Cost:** It is concerned with the cost of foregone opportunity.
 - **Direct costs:** The costs that are readily identified and are traceable to a particular product or product line.
 - **Indirect costs:** The costs that are not readily identifiable or visibly traceable to a particular product or line of products.



- **Fixed Costs:** The costs which do not vary with output up to a certain level of activity are called fixed costs. These cannot be avoided
- **Variable costs:** The costs that are a function of output in the production period. They vary with the level of output.
- Cost function refers to the mathematical relation between cost of a production and the various determinants of costs.
- Economists are generally interested in two types of cost functions; the short run cost function and the long run cost function.
- **Short-run cost functions are**
 - **Fixed costs:** They do not change with changes in output.
 - **Variable Cost:** The cost which changes with changes in output.
 - **Total Cost:** Total money expenses incurred for buying the inputs required for producing a commodity or a service. Total cost is equal to the total fixed costs plus total variable costs.
 - **Semi variable costs:** The costs which are neither perfectly variable nor absolutely fixed.
 - **Stair-step Variable Costs:** The costs which may increase in a stair-step fashion
 - **Average Fixed Cost:** AFC is the total fixed cost divided by the number of units of output.
 - **Average Variable cost:** Average variable cost is the total variable cost divided by the number of units of output produced.
 - **Average total cost:** Average total cost is the sum of average variable cost and average fixed cost.
 - **Marginal Cost:** Marginal cost is the addition made to the total cost by the production of an additional unit of output.
- **Long-run Average Cost:** The long run average cost curve initially falls with increase in output and after a certain point, it rises making a boat shape. It is also called planning curve or envelope curve.
- Modern firms face 'L' shaped cost curve than U shaped curve due to change in technology.

MULTIPLE CHOICE QUESTIONS

1. Which of the following is considered production in Economics?
 - (a) Tilling of soil.
 - (b) Singing a song before friends.
 - (c) Preventing a child from falling into a manhole on the road.
 - (d) Painting a picture for pleasure.
2. Identify the correct statement :
 - (a) The average product is at its maximum when marginal product is equal to average product.

- (b) The law of increasing returns to scale relates to the effect of changes in factor proportions.
 - (c) Economies of scale arise only because of indivisibilities of factor proportions.
 - (d) Internal economies of scale can accrue only to the exporting sector.
3. Which of the following is not a characteristic of land?
- (a) Its supply for the economy is limited.
 - (b) It is immobile.
 - (c) Its usefulness depends on human efforts.
 - (d) It is produced by our forefathers.
4. Which of the following statements is true?
- (a) Accumulation of capital depends solely on income.
 - (b) Savings can also be affected by the State.
 - (c) External economies go with size and internal economies with location.
 - (d) The supply curve of labour is an upward slopping curve.
5. In the production of wheat, all of the following are variable factors that are used by the farmer except :
- (a) the seed and fertilizer used when the crop is planted.
 - (b) the field that has been cleared of trees and in which the crop is planted.
 - (c) the tractor used by the farmer in planting and cultivating not only wheat but also corn and barley.
 - (d) the number of hours that the farmer spends in cultivating the wheat fields.
6. The marginal product of a variable input is best described as:
- (a) total product divided by the number of units of variable input.
 - (b) the additional output resulting from a one unit increase in the variable input.
 - (c) the additional output resulting from a one unit increase in both the variable and fixed inputs.
 - (d) the ratio of the amount of the variable input that is being used to the amount of the fixed input that is being used.
7. Diminishing marginal returns implies:
- (a) decreasing average variable costs.
 - (b) decreasing marginal costs.
 - (c) increasing marginal costs.
 - (d) decreasing average fixed costs.



8. The short run, as economists use the phrase, is characterized by:
 - (a) at least one fixed factor of production and firms neither leaving nor entering the industry.
 - (b) a period where the law of diminishing returns does not hold.
 - (c) no variable inputs – that is all of factors of production are fixed.
 - (d) all inputs being variable.
9. The marginal, average, and total product curves encountered by the firm producing in the short run exhibit all of the following relationships except:
 - (a) when total product is rising, average and marginal product may be either rising or falling.
 - (b) when marginal product is negative, total product and average product are falling.
 - (c) when average product is at a maximum, marginal product equals average product, and total product is rising.
 - (d) when marginal product is at a maximum, average product equals marginal product, and total product is rising.
10. To economists, the main difference between the short run and the long run is that :
 - (a) in the short run all inputs are fixed, while in the long run all inputs are variable.
 - (b) in the short run the firm varies all of its inputs to find the least-cost combination of inputs.
 - (c) in the short run, at least one of the firm’s input levels is fixed.
 - (d) in the long run, the firm is making a constrained decision about how to use existing plant and equipment efficiently.
11. Which of the following is the best definition of “production function”?
 - (a) The relationship between market price and quantity supplied.
 - (b) The relationship between the firm’s total revenue and the cost of production.
 - (c) The relationship between the quantities of inputs needed to produce a given level of output.
 - (d) The relationship between the quantity of inputs and the firm’s marginal cost of production.
12. The “law of diminishing returns” applies to :
 - (a) the short run, but not the long run.
 - (b) the long run, but not the short run.
 - (c) both the short run and the long run.
 - (d) neither the short run nor the long run.

13. Diminishing returns occur :
- (a) when units of a variable input are added to a fixed input and total product falls.
 - (b) when units of a variable input are added to a fixed input and marginal product falls.
 - (c) when the size of the plant is increased in the long run.
 - (d) when the quantity of the fixed input is increased and returns to the variable input falls.

Use the following information to answer questions 14-16.

Hours of Labour	Total Output	Marginal Product
0	---	---
1	100	100
2	_____	80
3	240	_____

14. What is the total output when 2 hours of labour are employed?
- (a) 80
 - (b) 100
 - (c) 180
 - (d) 200
15. What is the marginal product of the third hour of labour?
- (a) 60
 - (b) 80
 - (c) 100
 - (d) 240
16. What is the average product of the first three hours of labour?
- (a) 60
 - (b) 80
 - (c) 100
 - (d) 240
17. Which cost increases continuously with the increase in production?
- (a) Average cost.
 - (b) Marginal cost.



- (c) Fixed cost.
(d) Variable cost.
18. Which of the following cost curves is never 'U' shaped?
(a) Average cost curve.
(b) Marginal cost curve.
(c) Average variable cost curve
(d) Average fixed cost curve.
19. Total cost in the short run is classified into fixed costs and variable costs. Which one of the following is a variable cost?
(a) Cost of raw materials.
(b) Cost of equipment.
(c) Interest payment on past borrowings.
(d) Payment of rent on building.
20. In the short run, when the output of a firm increases, its average fixed cost :
(a) increases.
(b) decreases.
(c) remains constant.
(d) first declines and then rises.
21. Which one of the following is also known as planning curve?
(a) Long run average cost curve.
(b) Short run average cost curve.
(c) Average variable cost curve.
(d) Average total cost curve.
22. The cost of one thing in terms of the alternative given up is known as:
(a) production cost.
(b) physical cost.
(c) real cost.
(d) opportunity cost.
23. With which of the following is the concept of marginal cost closely related?
(a) variable cost.
(b) fixed cost.
(c) opportunity cost.
(d) economic cost.

24. Which of the following statements is correct?
- When the average cost is rising, the marginal cost must also be rising.
 - When the average cost is rising, the marginal cost must be falling.
 - When the average cost is rising, the marginal cost is above the average cost.
 - When the average cost is falling, the marginal cost must be rising.
25. Which of the following is an example of "explicit cost"?
- The wages a proprietor could have made by working as an employee of a large firm.
 - The income that could have been earned in alternative uses by the resources owned by the firm.
 - The payment of wages by the firm.
 - The normal profit earned by a firm.
26. Which of the following is an example of an "implicit cost"?
- Interest that could have been earned on retained earnings used by the firm to finance expansion.
 - The payment of rent by the firm for the building in which it is housed.
 - The interest payment made by the firm for funds borrowed from a bank.
 - The payment of wages by the firm.

Use the following data to answer questions 27-29.

Output (O)	0	1	2	3	4	5	6
Total Cost (TC) :	₹ 240	₹ 330	₹ 410	₹ 480	₹ 540	₹ 610	₹ 690

27. The average fixed cost of 2 units of output is :
- ₹ 80
 - ₹ 85
 - ₹ 120
 - ₹ 205
28. The marginal cost of the sixth unit of output is :
- ₹ 133
 - ₹ 75
 - ₹ 80
 - ₹ 450
29. Diminishing marginal returns start to occur between units :
- 2 and 3.
 - 3 and 4.
 - 4 and 5.
 - 5 and 6.



30. Marginal cost is defined as :
- (a) the change in total cost due to a one unit change in output.
 - (b) total cost divided by output.
 - (c) the change in output due to a one unit change in an input.
 - (d) total product divided by the quantity of input.
31. Which of the following is true of the relationship between the marginal cost function and the average cost function?
- (a) If MC is greater than ATC, then ATC is falling.
 - (b) The ATC curve intersects the MC curve at minimum MC.
 - (c) The MC curve intersects the ATC curve at minimum ATC.
 - (d) If MC is less than ATC, then ATC is increasing.
32. Which of the following statements is true of the relationship among the average cost functions?
- (a) $ATC = AFC - AVC$.
 - (b) $AVC = AFC + ATC$.
 - (c) $AFC = ATC + AVC$.
 - (d) $AFC = ATC - AVC$.
33. Which of the following is not a determinant of the firm's cost function?
- (a) The production function.
 - (b) The price of labour.
 - (c) Taxes.
 - (d) The price of the firm's output.
34. Which of the following statements is correct concerning the relationships among the firm's cost functions?
- (a) $TC = TFC - TVC$.
 - (b) $TVC = TFC - TC$.
 - (c) $TFC = TC - TVC$.
 - (d) $TC = TVC - TFC$.
35. Suppose output increases in the short run. Total cost will :
- (a) increase due to an increase in fixed costs only.
 - (b) increase due to an increase in variable costs only.
 - (c) increase due to an increase in both fixed and variable costs.
 - (d) decrease if the firm is in the region of diminishing returns.

36. Which of the following statements concerning the long-run average cost curve is false?
- (a) It represents the least-cost input combination for producing each level of output.
 - (b) It is derived from a series of short-run average cost curves.
 - (c) The short-run cost curve at the minimum point of the long-run average cost curve represents the least-cost plant size for all levels of output.
 - (d) As output increases, the amount of capital employed by the firm increases along the curve.
37. The negatively-sloped (i.e. falling) part of the long-run average total cost curve is due to which of the following?
- (a) Diseconomies of scale.
 - (b) Diminishing returns.
 - (c) The difficulties encountered in coordinating the many activities of a large firm.
 - (d) The increase in productivity that results from specialization.
38. The positively sloped (i.e. rising) part of the long run average total cost curve is due to which of the following?
- (a) Diseconomies of scale.
 - (b) Increasing returns.
 - (c) The firm being able to take advantage of large-scale production techniques as it expands its output.
 - (d) The increase in productivity that results from specialization.
39. A firm's average total cost is ₹ 300 at 5 units of output and ₹ 320 at 6 units of output. The marginal cost of producing the 6th unit is :
- (a) ₹ 20
 - (b) ₹ 120
 - (c) ₹ 320
 - (d) ₹ 420
40. A firm producing 7 units of output has an average total cost of ₹ 150 and has to pay ₹ 350 to its fixed factors of production whether it produces or not. How much of the average total cost is made up of variable costs?
- (a) ₹ 200
 - (b) ₹ 50
 - (c) ₹ 300
 - (d) ₹ 100



41. A firm has a variable cost of ₹ 1000 at 5 units of output. If fixed costs are ₹ 400, what will be the average total cost at 5 units of output?
- (a) ₹ 280
 - (b) ₹ 60
 - (c) ₹ 120
 - (d) ₹ 1400
42. A firm's average fixed cost is ₹ 20 at 6 units of output. What will it be at 4 units of output?
- (a) ₹ 60
 - (b) ₹ 30
 - (c) ₹ 40
 - (d) ₹ 20
43. Which of the following statements is true?
- (a) The services of a doctor are considered production.
 - (b) Man can create matter.
 - (c) The services of a housewife are considered production.
 - (d) When a man creates a table, he creates matter.
44. Which of the following is a function of an entrepreneur?
- (a) Initiating a business enterprise.
 - (b) Risk bearing.
 - (c) Innovating.
 - (d) All of the above.
45. In describing a given production technology, the short run is best described as lasting:
- (a) up to six months from now.
 - (b) up to five years from now.
 - (c) as long as all inputs are fixed.
 - (d) as long as at least one input is fixed.
46. If decreasing returns to scale are present, then if all inputs are increased by 10% then:
- (a) output will also decrease by 10%.
 - (b) output will increase by 10%.
 - (c) output will increase by less than 10%.
 - (d) output will increase by more than 10%.
47. The production function is a relationship between a given combination of inputs and:
- (a) another combination that yields the same output.
 - (b) the highest resulting output.

- (c) the increase in output generated by one-unit increase in one output.
 - (d) all levels of output that can be generated by those inputs.
48. If the marginal product of labour is below the average product of labour, it must be true that:
- (a) the marginal product of labour is negative.
 - (b) the marginal product of labour is zero.
 - (c) the average product of labour is falling.
 - (d) the average product of labour is negative.
49. The average product of labour is maximized when marginal product of labour:
- (a) equals the average product of labour.
 - (b) equals zero.
 - (c) is maximized.
 - (d) none of the above.
50. The law of variable proportions is drawn under all of the assumptions mentioned below except the assumption that:
- (a) the technology is changing.
 - (b) there must be some inputs whose quantity is kept fixed.
 - (c) we consider only physical inputs and not economic profitability in monetary terms.
 - (d) the technology is given and stable.
51. What is a production process?
- a. technical relationship between physical inputs and physical output.
 - b. relationship between fixed factors of production and variable factors of production.
 - c. relationship between a factor of production and the utility created by it.
 - d. relationship between quantity of output produced and time taken to produce the output.
52. Laws of production does not include
- a. returns to scale.
 - b. law of diminishing returns to a factor
 - c. law of variable proportions.
 - d. least cost combination of factors.
53. Identify the fixed cost from the following:
- a. Labour cost.
 - b. Electricity bill
 - c. Salary of watchman
 - d. Cost of raw materials



54. Which of the following is not an assumption of the law of variable proportions
- Only one factor is variable.
 - Technique of production remains constant.
 - Proportion of factors of production remains same.
 - Units of variable factor are homogeneous.
55. Which of the following statements is correct?
- Supply of land is perfectly elastic.
 - Fertility of land cannot change.
 - Land does not yield any result unless human efforts are employed.
 - Supply of land can be increased.
56. The production process described below exhibits
- | Number of Workers | Output |
|-------------------|--------|
| 0 | 0 |
| 1 | 23 |
| 2 | 40 |
| 3 | 50 |
- constant marginal product of labour
 - diminishing marginal product of labour
 - increasing return to scale
 - increasing marginal product of labour
57. Which of the following is a variable cost in the short run?
- rent of the factory
 - wages paid to the factory labour
 - interest payments on borrowed financial capital
 - payment on the lease for factory equipment
58. The efficient scale of production is the quantity of output that minimizes
- average fixed cost
 - average total cost
 - average variable cost
 - marginal cost
59. If marginal cost equals average total cost,
- average total cost is falling
 - average total cost is rising

- c. average total cost is maximized
 - d. average total cost is minimized
60. In the long run
- a. all inputs are fixed
 - b. all inputs are variable
 - c. at least one input is variable and one input is fixed
 - d. at most one input is variable and one input is fixed
61. Average product is defined as
- a. total product divided by the total cost
 - b. total product divided by marginal product
 - c. total product divided by the variable input
 - d. marginal product divided by the variable input
62. The change in the total product resulting from a change in a variable input is
- a. average cost
 - b. average product
 - c. marginal cost
 - d. marginal product
63. Marginal product, mathematically, is the slope of the
- a. total product curve
 - b. average product curve
 - c. marginal product curve
 - d. implicit product curve
64. Suppose the first four units of a variable input generate corresponding total outputs of 200, 350, 450, 500. The marginal product of the third unit of input is:
- a. 50
 - b. 100
 - c. 150
 - d. 200
65. The law of diminishing marginal returns indicates that marginal return
- a. always diminish
 - b. eventually diminish
 - c. always diminish before increasing
 - d. never diminish before increasing



66. Diminishing marginal returns for the first four units of a variable input is exhibited by the total product sequence:
- 50,50,50,50
 - 50,110,180,260
 - 50, 100, 150, 200
 - 50, 90, 120, 140
67. If marginal product is equal to average product, then:
- marginal product is increasing
 - marginal product is decreasing
 - average product is decreasing
 - average product is not changing
68. In the third of the three stages of production:
- the marginal product curve has a positive slope
 - the marginal product curve lies completely below the average product curve
 - total product increases
 - marginal product is positive
69. When marginal costs are below average total costs,
- average fixed costs are rising
 - average total costs are falling
 - average total costs are rising
 - average total costs are minimized
70. If the average cost is falling, then:
- Marginal cost is rising
 - Marginal cost is falling
 - Marginal cost is equal to average cost
 - It is impossible to tell if marginal cost is rising or falling
71. In the long run, if a very small factory were to expand its scale of operations, it is likely that it would initially experience
- an increase in pollution level
 - diseconomies of scale
 - economies of scale
 - constant returns to scale
72. The difference between average total cost and average variable cost:
- is constant
 - is total fixed cost

- (c) gets narrow as output decreases
 (d) is the average fixed cost
73. In the long-run, some firms will exit the market if the price of the good offered for sale is less than
- marginal revenue
 - marginal cost
 - average total cost
 - average revenue
74. The marginal cost for a firm of producing the 9th unit of output is ₹ 20. Average cost at the same level of output is ₹ 15. Which of the following must be true?
- marginal cost and average cost are both falling
 - marginal cost and average cost are both rising
 - marginal cost is rising and average cost is falling
 - it is impossible to tell if either of the curves are rising or falling
75. Labour is defined as _____
- Any work done without remuneration
 - Any exertion of mind or body to get some reward
 - Helping the mother
 - Helping the friends
76. The most important function of an entrepreneur is to _____
- Innovate
 - Bear the sense of responsibility
 - Finance
 - Earn profit
77. Which one of the following is correct?
- Land is produced by man's efforts.
 - The supply of land is not constant.
 - Capital is not a result of savings.
 - Capital refers to the produced means of production.
78. Which one of the following is incorrect?
- Land has original and indestructible powers to produce
 - Labour has poor bargaining power.
 - Risk in a business concern can be insured.
 - The supply of land is not constant.



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79. Marginal cost changes due to changes in _____
- Total cost
 - Average cost
 - Variable cost
 - Quantity of output
80. Which of the following statements is correct?
- Fixed costs vary with change in output
 - If we add total variable cost and total fixed cost we get the average cost
 - Marginal cost is the result of total cost divided by number of units produced
 - Total cost is obtained by adding up the fixed cost and total variable cost
81. Which of the following statements is incorrect?
- The LAC curve is also called the planning curve of a firm
 - Total revenue = price per unit \times number of units sold
 - Opportunity cost is also called alternative cost
 - If total revenue is divided by the number of units sold we get marginal revenue.

ANSWERS

1.	a	2.	a	3.	d	4.	b	5.	b	6.	b
7.	c	8.	a	9.	d	10.	c	11.	c	12.	a
13.	b	14.	c	15.	a	16.	b	17.	d	18.	d
19.	a	20.	b	21.	a	22.	d	23.	a	24.	c
25.	c	26.	a.	27.	c.	28.	c	29.	c	30.	a.
31.	c	32.	d	33.	d	34.	c	35.	b	36.	c
37.	d	38.	a	39.	d	40.	d	41.	a	42.	b
43.	a	44.	d	45.	d	46.	c	47.	b	48.	c
49.	a	50.	a	51.	a	52.	d	53.	c	54.	c
55.	c	56.	b	57.	b	58.	b	59.	d	60.	b
61.	c	62.	d	63.	a	64.	b	65.	b	66.	d
67.	d	68.	b	69.	b	70.	d	71.	c	72.	d
73.	c	74.	b	75.	b	76.	a	77.	d	78.	d
79.	c	80	d	81.	d						