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 source of raw-material, adoption of new or improved forms of organisation, introduction of a new or improved product, opening of new or improved markets. According to Schumpeter, the task of the entrepreneur is to continuously introduce new innovations.

1.2 PRODUCTION FUNCTION

Production function states the 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.

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 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.). 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 laws of returns to scale.

1.2.1 Law of variable proportions : Before discussing this law, if 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, 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	430	107.5	100
5	520	104.0	90
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 100 units. This reflects the fact that an increase in labour from 3 to 4 units increased output from 330 to 430 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 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. AR↑ - MP > AP

(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 as a result of a decrease in the quantity of variable input, 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 product. When the various factors are required to be used in fixed proportions, then 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 factor variable. 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 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.

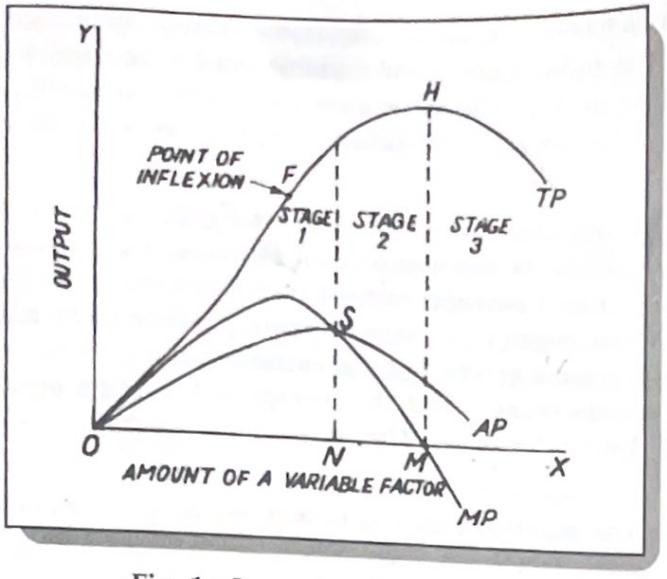

Fig. 1 : Law of variable proportions

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 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 marginal product curve first rises and then start 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 is more intensively and effectively utilised i.e., the efficiency of the fixed factors increases as additional units of the variable factors are added to it. 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 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, 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 we do 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 occurr 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, then 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, 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 one 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 constant quantity of the other, a stage is reached when the total product declines and marginal product become negative. This is due to the fact that the quantity of variable factor becomes too excessive relative to the fixed factor so that they get in each other's ways with a 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, the rational producer stops before the beginning of third stage.

The rational producer will also not produce in stage 1 where the marginal product of the fixed factor is negative. The producer producing in stage 1 will not be making best use of the fixed factor and he will not be utilising fully the opportunities of increasing production by increasing 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, the 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 the 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 a 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 some 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.

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 capacity of the 3 foot- cube box is 27 times greater than that of one foot cube. Many such examples are found in 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, then finally 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 same efficiency as previously.

1.3 ECONOMIES AND DISECONOMIES OF SCALE

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 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 or 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 finance department. If 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 greatly improve. Decentralisation of decision making authority

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 scale of production increases beyond a certain limit, managerial diseconomies set in. Management finds it difficult to exercise control and bring 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 big volumes of goods requires large amount of material and components. This enables the firm to place a bulk order for 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 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 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 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 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