

# **THEORY OF PRODUCTION AND COST**



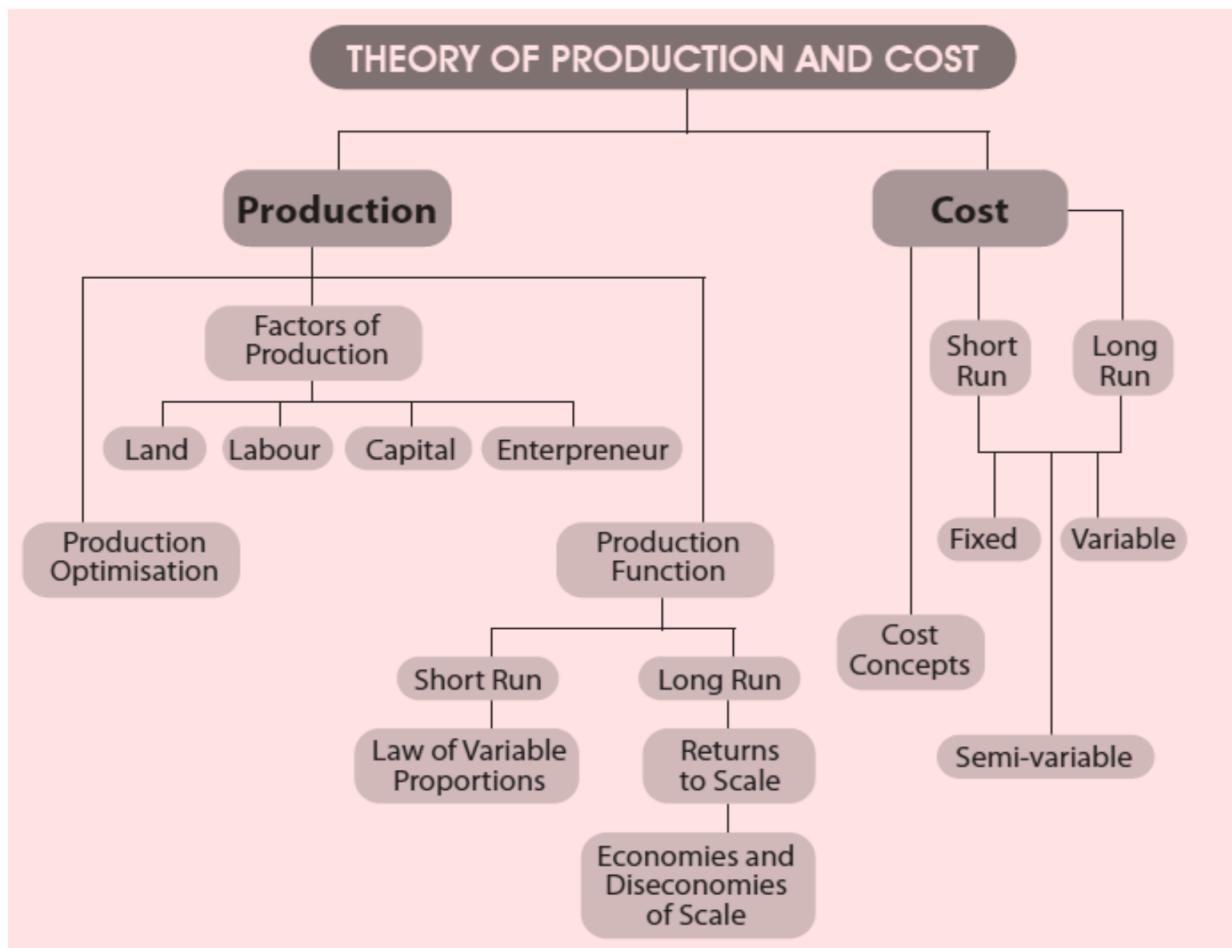
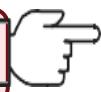
## **UNIT -1: THEORY OF PRODUCTION**

### **LEARNING OUTCOMES**

**After studying this unit, you would be able to:**

- ◆ Define Production and Describe Production Function.
- ◆ Describe the Characteristics of various Factors of Production.
- ◆ Distinguish between Short run and Long run Production Functions.
- ◆ Illustrate the Law of Diminishing Returns and Returns to Scale.
- ◆ Describe Production Optimisation using Isoquants and Iso-cost curves.

## CHAPTER OVERVIEW



### 1.0 MEANING OF PRODUCTION

Production is a very important economic activity. As we are aware, the survival of any firm in a competitive market depends upon its ability to produce goods and services at a competitive cost. One of the principal concerns of business managers is the achievement of optimum efficiency in production by minimising the cost of production. The performance of an economy is judged by the level of its production. The amount of goods and services an economy is able to produce determines the richness or poverty of that economy. In fact, the standard of living of people depends on the volume and variety of goods and services produced in a country. Thus, the U.S.A. is a rich country just because its level of production is high.

In common parlance, the term 'production' is used to indicate an activity of making something material. The growing of wheat, rice or any other agricultural crop by farmers and manufacturing of cement, radio-sets, wool, machinery or any other industrial product is often referred to as production. What exactly do we mean by production in Economics? In Economics the word 'production' is used in a wider sense to denote the process by which man utilises resources such as men, material, capital, time etc, working upon them to transform them into commodities and services so as to make them satisfy human wants. In other words, production is any economic activity which converts inputs into outputs which are capable of satisfying human wants. Whether it is making of material goods or providing a service, it is included in production provided it satisfies the wants of some people. Therefore, in Economics, activities such as making of cloth by an industrial worker, the services of the retailer who delivers it to consumers, the work of doctors, lawyers, teachers, actors, dancers, etc. are production.

**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 to things that already exist in nature. Production can also be defined as creation or addition of utility. For example, when a carpenter produces a table, he does not create the matter of which the wood is composed of; he only transforms wood into a table. By doing so, he adds utility to wood which did not have utility before.

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 use of physical inputs such as raw materials and transforming them into physical products 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 a 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 a little utility 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. These examples emphasise the additional utility conferred on 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 food grains 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. Thus, production is nothing but 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, the 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.

It should be noted that the production process need not necessarily involve conversion of physical inputs into physical output. For example, production of services such as those of lawyers, doctors, musicians, consultants etc. involves intangible inputs to produce intangible output. But, production does not include work done within a household by anyone out of love and affection, voluntary services and goods produced for self-consumption. Intention to exchange in the market is an essential component of production.

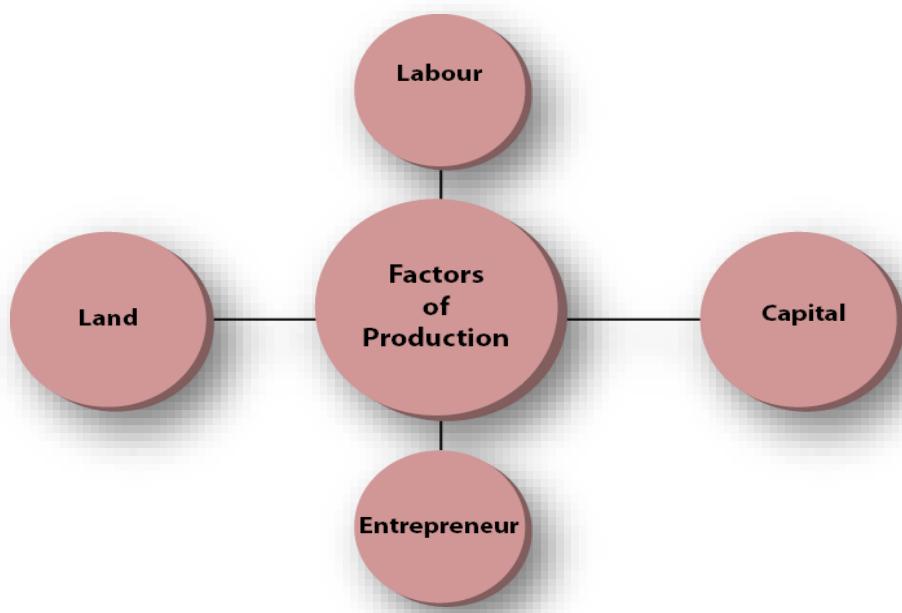
The money expenses incurred in the process of production, i.e., for transforming resources into finished products constitute the cost of production. Although cost of production is not taken into account for a pure production analysis, it is an extremely vital matter for any business decision-making. Nevertheless, in the theory of production, we would confine ourselves to laws of production, production function and methods of production optimisation. However, it is necessary to remember that a production decision cannot

depend merely on physical productivity based on operating efficiency alone. The profitability of a productive activity would depend upon the revenue realised from the output and the costs incurred in raising that output. Aspects of cost and revenue will be discussed in the following units.



## 1.1 FACTORS OF PRODUCTION

Factors of production refer to inputs. An input is a good or service which a firm buys for use in its production process. Production process requires a wide variety of inputs, depending on the nature of output. 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 consumers' hands in a finished form. Land, labour, capital and entrepreneurial ability are the four 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 land in common parlance, natural resources, fertility of soil, water, air, light, heat natural vegetation etc. It becomes difficult at times to state precisely as to what part of a given factor is due solely to 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 a free gift of nature:** No human effort is required for making land available for production. It has no supply price in the sense that no payment has been made to mother nature for obtaining land
- (ii) **Supply of land is fixed:** Land is strictly limited in quantity. It is different from other factors of production in that, no change in demand can affect the amount of land in existence. In other words, the total 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) **Land is permanent and has indestructible powers:** Land is permanent in nature and cannot be destroyed. According to Ricardo, land has certain original and indestructible powers and these properties of land cannot be destroyed.
- (iv) **Land is a passive factor:** Land is not an active factor. Unless human effort is exercised on land, it does not produce anything on its own.
- (v) **Land is immobile:** in the geographical sense. Land cannot be shifted physically from one place to another. The natural factors typical to a given place cannot be shifted to other places.
- (vi) **Land has multiple uses:** and can be used for varied purposes, though its suitability in all the uses is not the same.
- (vii) **Land is heterogeneous:** No two pieces of land are alike. They differ in fertility and situation.

## 1.1.1 Labour

The term 'labour', means any mental or physical exertion directed to produce goods or services. All human efforts of body or of mind 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 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:

- ◆ **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, there are certain human and psychological considerations which may come up unlike in the case of other factors. Therefore, leisure, fair treatment, favourable work environment etc. are essential for labourers.
- ◆ **Labour is perishable:** Labour is highly 'perishable' in the sense that a day's labour lost cannot be completely recovered by extra work on any other day. In other words, a labourer cannot store his labour.
- ◆ **Labour is an active factor:** Without the active participation of labour, land and capital may not produce anything.
- ◆ **Labour is inseparable from the labourer:** A labourer is the source of his own labour power. When a labourer sells his service, he has to be physically present where they are delivered. The labourer sells his labour against wages, but retains the capacity to work.
- ◆ **Labour power differs from labourer to labourer:** Labour is heterogeneous in the sense that labour power differs from person to person. Labour power or efficiency of labour depends upon the labourers' inherent and acquired qualities, characteristics of work environment, and incentive to work.
- ◆ **All labour may not be productive:** (i.e.) all efforts are not sure to produce resources.
- ◆ **Labour has poor bargaining power:** Labour has a weak bargaining power. Labour has no reserve price. Since labour cannot be stored, the labourer is compelled to work at the wages offered by the employers. For this reason, when compared to employers, labourers have poor bargaining power and can be exploited and forced to accept lower wages. The labourer is economically weak while the employer is

economically powerful although things have changed a lot in favour of labour during 20<sup>th</sup> and 21<sup>st</sup> centuries.

- ◆ **Labour is mobile:** Labour is a mobile factor. Apparently, workers can move from one job to another or from one place to another. However, in reality there are many obstacles in the way of free movement of labour from job to job or from place to place.
- ◆ **There is no rapid adjustment of supply of labour to the demand for it:** The total supply of labour cannot be increased or decreased instantly.
- ◆ **Choice between hours of labour and hours of leisure:** A labourer can make a choice between the hours of labour and the hours of leisure. This feature gives rise to a peculiar backward bending shape to the supply curve of labour. The supply of labour and wage rate is 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 desired 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.

### 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' or 'man-made instruments of production'. In other words, capital refers to all man made goods that are used for further production of wealth. 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. 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, fuel, 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 goes 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, copyrights, goodwill, patent rights, etc.

**Individual capital** is 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 has 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 when 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. Higher rate of capital formation will enhance production and productive capacity, increase the efficacy of production efforts, accelerate economic growth and add to opportunities for employment.

**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 far sighted and wants to make his future secure, he will save more. Moreover, the government can enforce compulsory savings on employed people by making insurance and provident fund compulsory. Government can also encourage saving by allowing tax deductions on income saved. 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; the saved money should enter into circulation and facilitate the process of capital formation. Availability of appropriate financial products and institutions is a necessary precondition for mobilisation of savings. 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 description of the fourth factor of production, 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 and separation of ownership and management, the tasks performed by a manager or organiser have become different from that 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:** In general, an entrepreneur performs the following functions:

- (i) **Initiating business enterprise and resource co-ordination:** An entrepreneur senses business opportunities, conceives project ideas, decides on scale of operation, products and processes and builds up, owns and manages his own enterprise. The first and the foremost function of an entrepreneur is to initiate a business enterprise. An entrepreneur perceives opportunity, organizes resources needed for exploiting that opportunity and exploits it. He undertakes the dynamic process of obtaining different factors of production such as land, labour and capital, bringing about co-ordination among them and using these economic resources to secure higher productivity and greater yield. An entrepreneur hires the services of various other factors of production and pays them fixed contractual rewards: labour is hired at predetermined 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 paying for all factors of production hired by him, 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 certain or fixed. He may earn profits, or incur losses. Other factors get the payments agreed upon, 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 every day. 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 and/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 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 improvement in techniques of production, making the existing techniques and machines obsolete. The entrepreneur has to assess and bear the risks. However, Frank Knight is of the opinion that profit is the reward for bearing uncertainties. An entrepreneur need not bear the foreseeable risks such as of fire, theft, burglary etc. as these can be insured against. Uncertainties are different from risks in the sense that these cannot be insured against and therefore, the entrepreneur has to bear them. For example genuine business uncertainties such as change in tastes,

emergence of competition etc. cannot be foreseen or insured against. Thus, an entrepreneur earns profits because he bears uncertainty in a dynamic economy where changes occur every day. While nearly all functions of an entrepreneur can be delegated or entrusted with paid managers, risk bearing cannot be delegated to anyone. Therefore, risk bearing is the most important function of an entrepreneur.

- (iii) **Innovations:** According to Schumpeter, the true function of an entrepreneur is to introduce innovations. Innovation refers to commercial application of a new idea or invention to better fulfilment of business requirements. Innovations, in a very broad sense, include the introduction of new or improved products, devices and production processes, utilisation of new or improved source of raw-materials, adoption of new or improved technology, novel business models, extending sales to unexplored markets etc. According to Schumpeter, the task of the entrepreneur is to continuously introduce new innovations. These innovations may bring in greater efficiency and competitiveness in business and bring in profits to the innovator. A successful innovation will be imitated by others in due course of time. Therefore, an innovation may yield profits for the entrepreneur for a short time but when it is widely adopted by others, the profits tend to disappear. The entrepreneurs promote economic growth of the country by introducing new innovations from time to time and contributing to technological progress. But innovations involve risks and only a few individuals in the society are capable of introducing new innovations. The greater the innovating ability, the greater the supply of entrepreneurs in the economy, and greater will be the rate of technological progress.

### **Enterprise's objectives and constraints**

The standard assumption about an enterprise is that its business activity is carried out with the sole objective of earning profits. However, in the real world, enterprises do not make decisions based exclusively on profit maximisation objective alone. Since an enterprise functions in the economic, social, political and cultural environment, its objectives will have to be set up in relation to its survival and growth in such environments.

Thus, the objectives of an enterprise may be broadly categorised under the following heads:

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

1. **Organic objectives:** The basic minimum objective of all kinds of enterprises is to survive or to stay alive. An enterprise can survive only if it is able to produce and distribute products or services at a price which enables it to recover its costs. If an enterprise does not recover its costs of staying in business, it will not be in a position to meet its obligations to its creditors, suppliers and employees with the result that it will be forced into bankruptcy. Therefore, survival of an enterprise is essential for the continuance of its business activity. Once the enterprise is assured of its survival, it will aim at growth and expansion.

Growth as an objective has assumed importance with the rise of professional managers. R.L. Marris's theory of firm assumes that the goal that managers of a corporate firm set for themselves is to maximise the firm's balanced growth rate subject to managerial and financial constraints. In corporate firms, the structural division of ownership and management, yields opportunity for managers to set goals which may not conform to the utility function of owner shareholders. It is pointed out that ability or success of the managers is judged by their performance in promoting the growth or expansion of the firm and rewards obtained by them are reflection of their success in achieving growth of the firms managed by them. While owners want to maximise their utility function which relate to profit, capital, market share and public reputation, the managers want to maximise their utility function which includes variables such as salary, power, and status and job security. Although there is divergence and some degree of conflict between these utility functions, Marris argues that most of the variables incorporated in both of them are positively related to size of the firm and therefore, the two utility functions converge into a single variable, namely, a steady growth in the size of the firm. The managers do not aim at optimising profits; rather they aim at optimisation of the balanced rate of growth of the firm which involves optimisation of the rate of increase of demand for the commodities of the firm and the rate of increase of capital supply.

2. **Economic objectives:** The profit maximising behaviour of the firm has been the most basic assumption made by economists over the last more than two hundred years and is still at the heart of neo classical micro economic theory. This assumption is simple, rational and quantitative and is amenable to equilibrium analysis. Under this assumption, the firm determines the price and output policy in such a way as to maximize profits within the constraints imposed upon it such as technology, finance etc. The investors expect that their company will earn sufficient profits in order to ensure fair dividends to them and to improve the prices of their stocks. Not only investors but creditors and employees are also interested in a profitable enterprise. Creditors will be reluctant to lend money to an enterprise which is not making

profits. Similarly, any increase in salaries, wages and perquisite of employees can come only out of profits.

The definition of profits in Economics is different from the accountants' definition of profits. Profit, in the accounting sense, is the difference between total revenue and total costs of the firm. Economic profit is the difference between total revenue and total costs, but total costs here costs include both explicit and implicit costs. Accounting profit considers only explicit costs while economic profit reflects explicit and implicit costs i.e. the cost of self-owned factors used by the entrepreneur in his own business. Since economic profit includes these opportunity costs associated with self-owned factors, it is generally lower than the accounting profit. When the economist speaks of profits, s/he means profits after taking into account the capital and labour provided by the owners i.e. s/he differentiates between normal profits and super normal profits. Normal profits include normal rate of return on capital invested by the entrepreneur, remuneration for the labour and the reward for risk bearing function of the entrepreneur.

Normal profit (zero economic profit) is a component of costs and therefore what a business owner considers as the minimum necessary to continue in the business. Supernormal profit, also called economic profit or abnormal profit is over and above normal profits. It is earned when total revenue is greater than the total costs. Total costs in this case include a reward to all the factors, including normal profit.

The profit maximisation objective has been subject to severe criticism in recent years. Many economists have pointed out that all firms do not aim to maximise profits. Some firms try to achieve security, subject to reasonable level of profits. H A Simon argues that firms have 'satisfying' behaviour and strive for profits that are satisfactory. Baumol's theory of sales maximisation holds that sales revenue maximisation rather than profit maximisation is the ultimate goal of the business firms. He cites empirical evidence for his hypothesis that sales rank ahead of profits as the main objective of the enterprise. He asserts that it is quite a common experience that when an executive is asked about his business, he will answer that his sales have been increasing (or decreasing) and talks about profits only as an afterthought. He, however, points out that in their attempt to maximise sales, businessmen do not completely ignore costs incurred on output and profits to be made.

In 1932, A. A. Berle and G.C. Means pointed out that in large business corporations, management is separated from ownership and therefore the managers enjoy discretionary powers to set goals of the firm they manage. Williamson's model of maximisation of managerial utility function is an important contribution to

managerial theory of firms' behaviour. The owners (shareholders) of joint stock companies prefer profit maximisation; but managers maximise their own utility function subject to a minimum profit, rather than maximising profit.

The objective of utility maximization has been discussed in the context of two types of firms: First in case of firms owned and managed by the entrepreneur himself, utility maximisation implies that in choosing an output level, the entrepreneur owner considers not only the money profits which he will make, but also the sacrifice of leisure which he would have to make in doing the necessary activity for producing that level of output. Second, in case of large joint stock companies, the utility function of managers or executives of these companies includes not only the profits which they earn for the shareholders but also the promotion of sales, maintaining lavish offices, seeking to have a larger member of staff under their supervision etc. In this case, the manager will maximise his utility by attaining a best combination of profits and the above mentioned other objectives. Cyert and March suggests four possible functional goals in addition to profit goal namely, production goal, inventory goal, sales goal and market share goal.

**3. Social objectives:** Since an enterprise lives in a society, it cannot grow unless it meets the needs of the society. Some of the important social objectives of business are:

- ◆ To maintain a continuous and sufficient supply of unadulterated goods and articles of standard quality.
- ◆ To avoid profiteering and anti-social practices.
- ◆ To create opportunities for gainful employment for the people in the society.
- ◆ To ensure that the enterprise's output does not cause any type of pollution - air, water or noise.

An enterprise should consistently endeavour to contribute to the quality of life of its community in particular and the society in general. If it fails to do so, it may not survive for long.

**4. Human objectives:** Human beings are the most precious resources of an organisation. If they are ignored, it will be difficult for an enterprise to achieve any of its other objectives. Therefore, the comprehensive development of its human resource or employees' should be one of the major objectives of an organisation. Some of the important human objectives are:

- ◆ To provide fair deal to the employees at different levels

- ◆ To develop new skills and abilities and provide a work climate in which they will grow as mature and productive individuals.
- ◆ To provide the employees an opportunity to participate in decision-making in matters affecting them.
- ◆ To make the job contents interesting and challenging.

If the enterprise is conscious of its duties towards its employees, it will be able to secure their loyalty and support.

5. **National objectives:** An enterprise should endeavour for fulfilment of national needs and aspirations and work towards implementation of national plans and policies. Some of the national objectives are:

- ◆ To remove inequality of opportunities and provide fair opportunity to all to work and to progress.
- ◆ To produce according to national priorities.
- ◆ To help the country become self-reliant and avoid dependence on other nations.
- ◆ To train young men as apprentices and thus contribute in skill formation for economic growth and development.

Since all the enterprises have multiple goals, they need to set priorities. This requires appropriate balancing of the objectives in order to determine the relative importance of each.

Various objectives of an enterprise may conflict with one another. For example, the profit maximisation objective may not be wholly consistent with the marketing objective of increasing its market share which may involve improvement in quality, slashing down of product prices, improved customer service, etc. Similarly, its social responsibility objective may run into conflict with the introduction of technological changes which may cause unemployment or environmental pollution. In such situations, the manager has to strike a balance between the two so that both can be achieved with reasonable success.

In the above paragraphs, we have discussed the different objectives of an enterprise. However, no comprehensive economic theory explaining the multitudes of behaviour of firms under various market conditions (perfect competition, monopoly, etc.) has been developed so far. Therefore, in rest of this book, we shall continue to assume that firms aim at maximising profits until and unless otherwise mentioned.

In the pursuit of this objective, an enterprise's actions may get constrained by many factors. Important among them are:

- ◆ Lack of knowledge and information: The enterprise functions in an uncertain world where due to lack of accurate information, many variables that affect the performance of the firm cannot be correctly predicted for the current month or the current year, let alone for the future years. Similarly, the firms may not know about the prices of all inputs and the characteristics of all relevant technologies. Under such circumstances, it is very difficult to determine what the profit maximising price is.
- ◆ There may be other constraints such as restrictions imposed in the public interest by the state on the production, price and movement of factors. In practice, there are several hindrances for free mobility of labour and capital. For example, trade unions may place several restrictions on the mobility of labour or specialised training may be required to enable workers to change occupation. These contingencies may make attainment of maximum profits a difficult task.
- ◆ There may be infrastructural inadequacies and consequent supply chain bottlenecks resulting in shortages and unanticipated emergencies. For example, there could be frequent power cuts, irregular supply of raw-materials or non-availability of proper transport. This could put limitations on the power of enterprises to maximise profits.
- ◆ Changes in business and economic conditions which become contagious due to the highly connected nature of economies, place constraints by causing demand fluctuations and instability in firms' sales and revenues. Besides, external factors such as sudden change in government policies with regard to location, prices, taxes, production, etc. or natural calamities like fire, flood etc. may place additional burdens on the business firms and defeat their plans. When firms are forced to implement policies in response to fiscal limitations, legal, regulatory, or contractual requirements, these have adverse consequences on the firms' profitability and growth plans.
- ◆ Events such as inflation, rising interest rates, unfavourable exchange rate fluctuations cause increased raw material, capital and labour costs and affect the budgets and financial plans of firms. Significant constraints are also imposed by the inability of firms to find skilled workforce at competitive wages as well as due to the recurring need for personnel training.

### **Enterprise's Problems**

An enterprise faces a number of problems from its inception, through its life time and till its closure. We shall try to get a few insights about them from the following discussion.

**Problems relating to objectives:** As mentioned earlier, an enterprise functions in the economic, social, political and cultural environment. Therefore, it has to set its objectives in relation to its environment. The problem is that these objectives are multifarious and very often conflict with one another. For example, the objective of maximising profits is in conflict with the objective of increasing the market share which generally involves improving the quality, slashing the prices etc. Thus the enterprise faces the problem of not only choosing its objectives but also striking a balance among them.

**Problems relating to location and size of the plant:** An enterprise has to decide about the location of its plant. It has to decide whether the plant should be located near the source of raw material or near the market. It has to consider costs such as cost of labour, facilities and cost of transportation. Of course, the entrepreneur will have to weigh the relevant factors against one another in order to choose the right location which is most economical.

Another problem relates to the size of the firm. It has to decide whether it is to be a small scale unit or large scale unit. Due consideration will have to be given to technical, managerial, marketing and financial aspects of the proposed business before deciding on the scale of operations. It goes without saying that the management must make a realistic evaluation of its strengths and limitations while choosing a particular size for a new unit.

**Problems relating to selecting and organising physical facilities:** A firm has to make decision on the nature of production process to be employed and the type of equipments to be installed. The choice of the process and equipments will depend upon the design chosen and the required volume of production. As a rule, production on a large scale involves the use of elaborate, specialized and complicated machinery and processes. Quite often, the entrepreneur has to choose from among different types of equipments and processes of production. Such a choice will be based on the evaluation of their relative cost and efficiency. Having determined the equipment to be used and the processes to be employed, the entrepreneur will prepare a layout illustrating the arrangement of equipments and buildings and the allocation for each activity.

**Problems relating to Finance:** An enterprise has to undertake not only physical planning but also expert financial planning. Financial planning involves (i) determination of the amount of funds required for the enterprise with reference to the physical plans already prepared (ii) assessment of demand and cost of its products (iii) estimation of profits on investment and comparison with the profits of comparable existing concerns to find out whether the proposed investment will be profitable enough and (iv) determining capital structure and the appropriate time for financing the enterprise etc.

**Problems relating to organisation structure:** An enterprise also faces problems relating to the organisational structure. It has to divide the total work of the enterprise into major specialised functions and then constitute proper departments for each of its specialized

functions. Not only this, the functions of all the positions and levels would have to be clearly laid down and their inter-relationship (in terms of span of control, authority, responsibility, etc) should be properly defined. In the absence of clearly defined roles and relationships, the enterprise may not be able to function efficiently.

**Problems relating to marketing:** Proper marketing of its products and services is essential for the survival and growth of an enterprise. For this, the enterprise has to discover its target market by identifying its actual and potential customers, and determine tactical marketing tools it can use to produce desired responses from its target market. After identifying the market, the enterprise has to make decision regarding 4 P's namely,

- ◆ **Product:** variety, quality, design, features, brand name, packaging, associated services, utility etc.
- ◆ **Promotion:** Methods of communicating with consumers through personal selling, social contacts, advertising, publicity etc.
- ◆ **Price:** Policies regarding pricing, discounts, allowance, credit terms, concessions, etc.
- ◆ **Place:** Policy regarding coverage, outlets for sales, channels of distribution, location and layout of stores, inventory, logistics etc.

**Problems relating to legal formalities:** A number of legal formalities have to be carried out during the time of launching of the enterprise as well as during its life time and its closure. These formalities relate to assessing and paying different types of taxes (corporate tax, excise duty, sales tax, custom duty, etc.), maintenance of records, submission of various types of information to the relevant authorities from time to time, adhering to various rules and laws formulated by government (for example, laws relating to location, environmental protection and control of pollution, size, wages and bonus, corporate management licensing, prices) etc.

**Problems relating to industrial relations:** With the emergence of the present day factory system of production, the management has to devise special measures to win the co-operation of a large number of workers employed in industry. Misunderstanding and conflict of interests have assumed enormous dimensions that these cannot be easily and promptly dealt with. Industrial relations at present are much more involved and complicated. Various problems which an enterprise faces with regard to industrial relations are - the problem of winning workers' cooperation, the problem of enforcing proper discipline among workers, the problem of dealing with organised labour and the problem of establishing a state of democracy in the industry by associating workers with the management of industry.



## 1.2 PRODUCTION FUNCTION

The production function is a statement of the relationship between a firm's scarce resources (i.e. its inputs) and the output that results from the use of these resources. More specifically, it states technological relationship between inputs and output. The production function can be algebraically expressed in the form of 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  $a, b, c, d \dots n$ , are the different factors (inputs) and services used per unit of time.

**Assumptions of Production Function:** There are three main assumptions underlying any production function.

First we assume that the relationship between inputs and outputs exists for a specific period of time. In other words, Q is not a measure of accumulated output over time.

Second, it is assumed that there is a given "state-of-the-art" in the production technology. Any innovation would cause change in the relationship between the given inputs and their output. For example, use of robotics in manufacturing or a more efficient software package for financial analysis would change the input-output relationship.

Third assumption is that whatever input combinations are included in a particular function, the output resulting from their utilization is at the maximum level.

The production function can be defined 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 i.e., the maximum amount of output that can be produced with given quantities of inputs under a given state of technical knowledge. (Samuelson)**

**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. To illustrate, for a company which produces beverages, the inputs could be fixed assets such as plant and machinery; raw materials such as carbonated water, sweeteners and flavourings and labour such as assembly line workers, support-staff and supervisory personnel.

For the purpose of analysis, the whole array of inputs in the production function can be reduced to two; L and K. Restating the equation given above, we get:

$Q = f(L, K)$ . Where  $Q$  = Output

$L$  = Labour

$K$  = Capital

### Short-Run Vs Long-Run Production Function

The production function of a firm can be studied in the context of short period or long period. It is to be noted that in economic analysis, the distinction between short-run and long-run is not related to any particular measurement of time (e.g. days, months, or years). In fact, it refers to the extent to which a firm can vary the amounts of the inputs in the production process. A period will be considered short-run period if the amount of at least one of the inputs used remains unchanged during that period. Thus, short-run production function shows the maximum amount of a good or service that can be produced by a set of inputs, assuming that the amount of at least one of the inputs used remains fixed (or unchanged). Generally, it has been observed that during the short period or in the short run, a firm cannot install a new capital equipment to increase production. It implies that capital is a fixed factor in the short run. Thus, in the short-run, the production function is studied by holding the quantities of capital fixed, while varying the amount of other factors (labour, raw material etc.) This is done when the law of variable proportion is studied.

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 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 variable factors of production. A long-run production function shows the maximum quantity of a good or service that can be produced by a set of inputs, assuming that the firm is free to vary the amount of all the inputs being used. The behaviour of production when all factors are varied is the subject matter of the law of returns to scale.

### 1.2.0 Cobb-Douglas Production Function

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

Cobb-Douglas production function is stated as:

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

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. Although, the Cobb-Douglas production function suffers from many shortcomings, it is extensively used in Economics as an approximation.

### **1.2.1 The Law of Variable Proportions or The Law of Diminishing Returns**

In the short run, the input output relations are studied with one variable input (labour) with all other inputs held constant. The laws of production under these conditions are known under various names as the law of variable proportions (as the behaviour of output is studied by changing the proportion in which inputs are combined) the law of returns to a variable input (as any change in output is taken as resulting from the additional variable input) or the law of diminishing returns (as returns eventually diminish).

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 input will become less and less.

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) of Table 1 presents the quantity of variable factor (labour) used along with the factors whose quantity is held constant and column (2) represent the total product at various levels of use of the variable input.

**Table 1: Product Schedule**

<b>Quantity of labour</b>	<b>Total Product (TP)</b>	<b>Average Product (AP)</b>	<b>Marginal Product (MP)</b>
(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	750	75.0	0
11	740	67.3	-10

We find that when one unit of labour is employed along with other factors of production, 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 9 or 10 units of labour, the total product rises to maximum level of 750 units. When 11 units of labour are employed, total product falls to 740 units due to negative returns from the 11<sup>th</sup> unit of labour.

**Average Product (AP):** Average product is the total product per unit of the variable factor.

$$AP = \frac{\text{Total Product}}{\text{No. of units of Variable Factors}}$$

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. Symbolically,

$$MP_n = TP_n - TP_{n-1}$$

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, has 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 the variable factor and marginal product is the change in total product resulting from a unit increase in the quantity of variable factor. The 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 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 factors of production cannot be increased or decreased simultaneously (for example, we cannot build a plant or dismantle a plant in the short run).

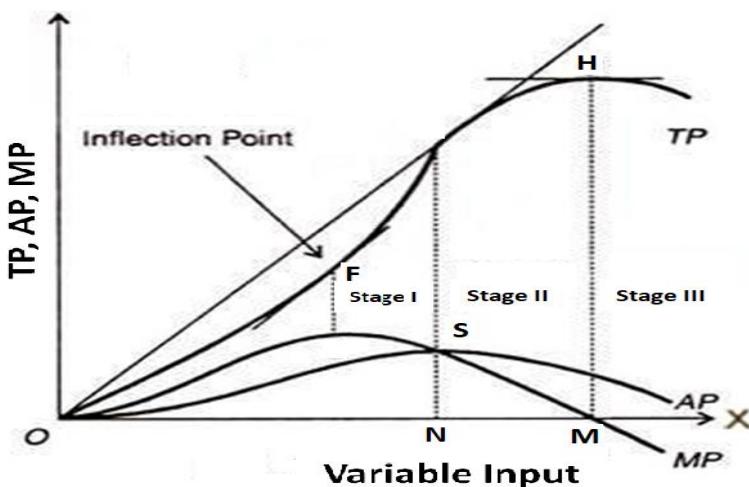
The law operates under certain assumptions which are as follows:

1. The state of technology is assumed to be given and unchanged. If there is any improvement in technology, then marginal product 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 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 the Total Product (TP), Average Product (AP) and Marginal Product (MP) are shown on the Y-axis. As the figure shows, the 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 Stage of Increasing Returns:** In this stage, the 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 the point of inflexion 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 law of increasing returns:** 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 the variable factor are added to the constant quantity of the fixed factors, 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 which are indivisible are taken as fixed. Indivisibility of a factor means that due to technological requirements, a minimum amount of that factor must be employed whatever be 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 factor are employed, the efficiency of the variable factor increases. This is because introduction of division of labour and specialisation becomes possible with sufficient quantity of the variable factor and these results in higher productivity.

**Stage 2: Stage of Diminishing Returns:** In stage 2, the total product continues to increase at a diminishing rate until it reaches its maximum at 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 within its range.

**Explanation of law of diminishing returns:** The question arises as to why 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 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: Stage 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 of negative returns:** 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. The optimum level of employment of the variable factor (here labour) will be determined by applying the principle of marginalism in such a way that the marginal revenue product of labour is equal to the marginal wages. (The principle of marginalism is explained in detail in the chapter discussing equilibrium in different types of markets.)

## 1.2.2 Returns to Scale

We shall now study about 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. Change 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 below. It should be kept in mind that the returns to scale faced by a firm are solely technologically determined and are not influenced by economic decisions taken by the firm or by market conditions.

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 doubling or trebling of all factors causes a doubling or trebling of output, then 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 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.

It should be remembered that increasing returns to scale is not the same as increasing marginal returns. Increasing returns to scale applies to 'long run' in which all inputs can be changed. Increasing marginal returns refers to the short run in which at least one input is fixed. The existence of fixed inputs in the short run gives rise to increasing and later to diminishing marginal returns.

**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. Constant returns to scale, otherwise called as "Linear Homogeneous Production Function", may be expressed as follows:

$$\begin{aligned} kQ_x &= f(kK, kL) \\ &= k(K, L) \end{aligned}$$

If all the inputs are increased by a certain amount (say  $k$ ) output increases in the same proportion ( $k$ ). 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 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 relative to an increase in all inputs, decreasing returns to scale are said to prevail. When a firm goes on expanding by increasing all inputs, decreasing 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 earlier.

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

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

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

- 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 profit maximising firm is interested to know what combination of factors of production (or inputs) would minimise its cost of production for a given output. This can be known by combining the firm's production and cost functions, namely isoquants and iso-cost lines respectively.

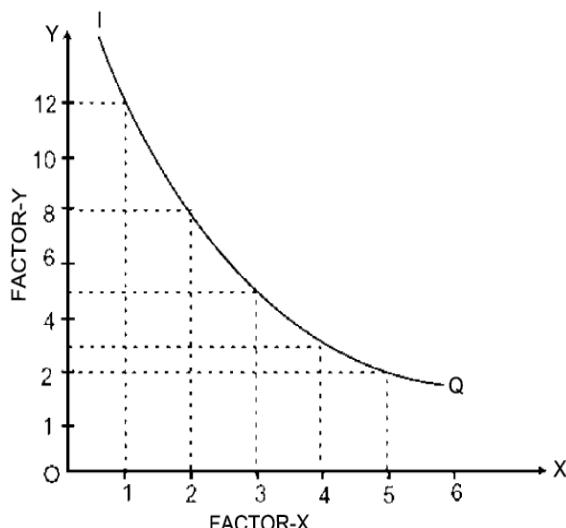
**Isoquants:** Isoquants are similar to indifference curves in the theory of consumer behaviour. An isoquant represents all those combinations of inputs which are capable of producing the same level of output. Since an isoquant curve represents all those combination of inputs which yield an equal quantity of output, the producer is indifferent as to which combination he chooses. Therefore, Isoquants are also called equal-product curves, production

indifference curves or iso-product curves. 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	MRTS
A	1	12	
B	2	08	4
C	3	05	3
D	4	03	2
E	5	02	1

When we plot the various combinations of factor X and factor Y, we get a curve IQ as shown in Figure 2.



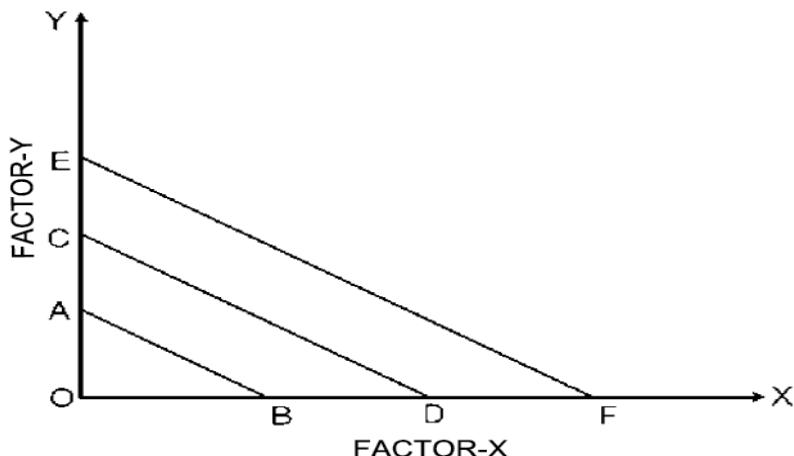
**Fig. 2 : Equal Product Curve or Isoquant**

Isoquants have properties similar to indifference curves. Isoquants are negatively sloped, convex to the origin due to diminishing marginal rate of technical substitution (MRTS) and are non-intersecting. However, 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 than on the left represents a lower level of output.

*Isocost or Equal-cost Lines:* Isocost line, also known as budget line or the budget constraint line, shows the various alternative combinations of two factors which the firm can buy with

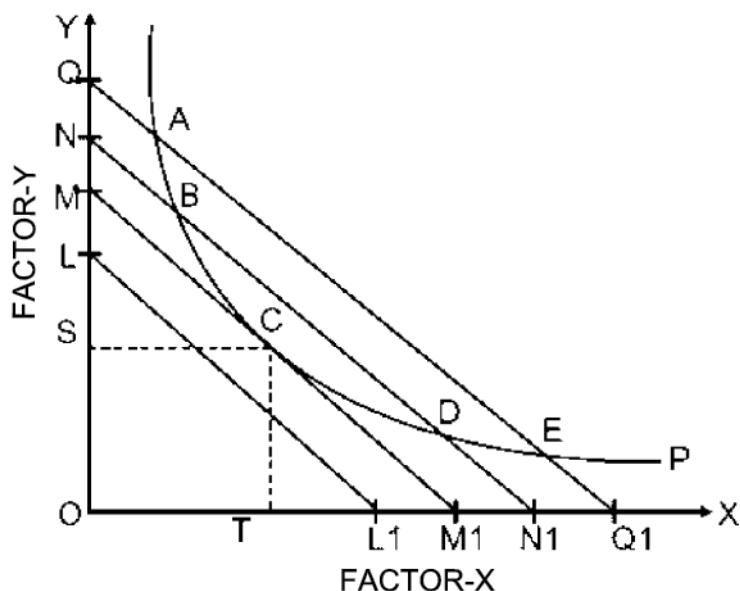
given outlay. Suppose a firm has ₹ 1,000 to spend on the two factors X and Y. If the price of factor X is ₹ 10 and that of Y is ₹ 20, the firm can spend its outlay on X and Y in various ways. It can spend the entire amount on X and thus buy 100 units of X and zero units of Y or it can spend the entire 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. Whatever be the combination of factors the firm chooses, the total cost to the firm remains the same. In other words, all points on a budget line would cost the firm the same amount.

We can show the iso-cost line diagrammatically also. The X-axis shows the units of factor X and Y-axis the units of factor Y. When the entire ₹ 1,000 is spent on factor X, we get OB of factor X and when the entire amount is spent on factor Y we get OA of factor Y. 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 ₹ 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. Isoquants, 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 the isoquant that represents the pre decided level of output on the 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 Compared to 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.

## SUMMARY

- ◆ Production is the outcome of the combined activity of the four factors of production viz, land, labour, capital and organization. In simple terms production, means 'creation of utility'. i.e. Utility of form, utility of place, utility of time and personal utility.
- ◆ Production does not include work done out of love and affection, voluntary services and goods produced for self-consumption. Intention to exchange in the market is an essential component of production.
- ◆ Land includes all those free natural resources whose supply for the economy as a whole is fixed.

- ◆ Labour is all human efforts of body or of mind undergone partly or wholly with a view to secure an income apart from the pleasure derived directly from the work.
- ◆ Capital is that part of wealth of an individual or community which is used for further production of wealth. Capital, a stock concept, refers to produced means of production and it comprises of man-made machines and materials which are used for further production.
- ◆ Capital formation, also known as investment, means a sustained increase in the stock of real capital in a country. There are mainly three stages of capital formation viz. Savings which depends on ability to save and willingness to save; Mobilisation of savings which depends on availability of financial institutions and products; and Investment i.e. the process whereby the real savings get converted into real capital assets.
- ◆ Entrepreneur is the person who organises business; initiates production, remunerates other factors of production, introduces innovations and bears the risk and uncertainties of business.
- ◆ The objectives of an enterprise may be broadly categorised under the following heads. (i) Organic objectives (ii) Economic objectives (iii) Social objectives (iv) Human objectives (v) National objectives.
- ◆ An enterprise faces a number of problems from its inception, through its life time and till its closure. These may relate to objectives, location, size, physical facilities, finance, organization structure, marketing, legal formalities and industrial relations.
- ◆ Factors of production can be divided into two categories – Fixed factors are those factors whose quantity remains unchanged with changes in output within a capacity and variable factors are those the quantity of which change with a change in the level of output.
- ◆ Production function is the 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.
- ◆ The law of variable proportion or the law of diminishing returns is relevant when some factors are kept fixed and others are varied. It is applicable to the short-run.
- ◆ There are three stages of the law of variable proportion – where law of increasing returns, law of diminishing returns and law of negative returns operate.
- ◆ 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.
- ◆ The 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.
- ◆ Isoquants or product indifference curves 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. the combination of factors of production which would minimise his cost of production.
- ◆ For producing a given output, the tangency point of the relevant isoquant (representing the output) with an iso-cost line represents the least cost combination of factors.