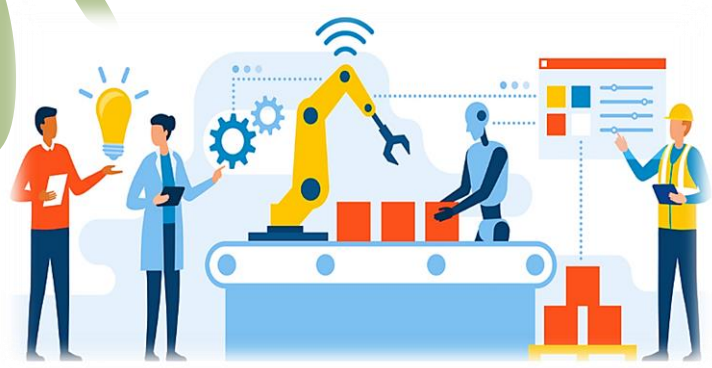
CHAPTER 3: THEORY OF PRODUCTION AND COST

UNIT 1: THEORY 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.

Meaning of Production

→*According to* ***James Bates and J.R. Parkinson*** *"Production is the organised 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 creation of matter because, according to the fundamental law of science, man cannot create matter. 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. 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:*

- ***Form Utility****: 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, Example: 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.***

- ***Place Utility:*** *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:*
  01. *Extraction from earth e.g., removal of coal, minerals, gold and other metal ores from mines and supplying them to markets.*

THE SHOW MUST GO ON!!

02. Transferring goods from where they give little or no satisfaction, to places where their utility is more.

03. Example: 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 a greater number of people.

➢ **Time Utility:** Making available materials at times when they are not normally available.

Example: Canning of seasonal fruits is undertaken to make them available during off-season. This may be called **conferring the utility of time**.

➢ **Personal Utility:** Making use of personal skills in the form of services. Example: Those of organisers, merchants, transport workers etc.

→Production process need not necessarily involve conversion of physical inputs into physical output. Example: Production of services such as those of lawyers, doctors, musicians, consultants etc. involves intangible inputs to produce intangible output.

→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 theory of production confines itself to laws of production, production function and methods of production optimization. Aspects relating to costing and revenue are not studied under production Function.

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.

→ Land, labour, capital and entrepreneurial ability are the four factors or resources which make it possible to produce goods and services.

CHAPTER 3: THEORY OF PRODUCTION AND COST

LAND → LABOUR → CAPITAL → ENTERPRENEUR

Land

Meaning of 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 the gift of nature and what part belongs to human effort made on it in the past.*

Features of Land

➔ **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.*

➔ **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.*

➔ **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.*

➔ **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.*

➔ **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.*

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

➔**Land has multiple uses:** Land can be used for varied purposes, though its suitability in all the uses is not the same.

➔**Land is heterogeneous:** No two pieces of land are alike. They differ in fertility and situation.

Labour

Meaning of 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.

Features 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.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

➔**All labour may not be productive:** All efforts are not sure to produce resources. In fact, productivity of different labour is something that is the prime factor for determining its role in the entire production process.

➔**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 20th and 21st 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 rest and leisure than earning more money.

Capital

Meaning of Capital: Capital as that part of wealth of an individual or community which is used for further production of wealth.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

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.

→ Example: Machine tools and instruments, factories, dams, canals, transport equipment etc., are some of the examples of capital.

Types of Capital

01. **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.
02. **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.
03. **Real capital** refers to physical goods such as buildings, plants, machines, etc.
04. **Human capital** refers to human skill and ability. This is called human capital because a good deal of investment has gone into creation of these abilities in humans.
05. **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, patents, goodwill, patent rights, etc.
06. **Individual capital** is personal property owned by an individual or a group of individuals.
07. **Social Capital** is what belongs to the society as a whole in the form of roads, bridges,etc

CHAPTER 3: THEORY OF PRODUCTION AND COST

Capital Formation

Meaning of 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 equipment, 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 for two reasons:-

1) Replacement and renovation

2) Creating additional productive capacity.

Stages of Capital Formation

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

Savings

A. **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.

B. **Willingness to save:** 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 nearsighted 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 funds compulsory. Government can also encourage saving by allowing tax deductions on income saved.

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 widespread network of banking and other financial institutions to collect public savings and to take them to prospective investors.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

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. Investments also depend upon the factors like expected profits, rate of interest, size of market, stability in the money value, internal peace and security, fear of foreign aggression, etc.

Entrepreneur

Meaning of Entrepreneur: The most important factor in production i.e., enterprise is provided by entrepreneurs. An entrepreneur is a person or group of persons who bring together the different factors of production i.e., land, labour and capital at one place; combine them in right proportions; initiate the process of production by making them work together and bear the risks and uncertainty involved in it. He is therefore also called the organiser, the manager or risk bearer.

Functions of an entrepreneur

Initiating a business enterprise	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, organises resources needed for exploiting that opportunity and exploits it. 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.

CHAPTER 3: THEORY OF PRODUCTION AND COST

<table>
<tr>
<td>Risk Bearing and Uncertainty bearing</td>
<td>The ultimate responsibility for the success and survival of business lies with the entrepreneur. It may happen that as a result of certain broad changes which were not anticipated by the entrepreneur, the firm has to incur losses. Various types of risks borne by entrepreneur are as:
<table>
<tr><td>Financial Risks</td><td>The risk that operations of the enterprise may not go on in the planned manner and ultimately entrepreneurs may have to incur losses is called financial risk.</td></tr>
<tr><td>Technological Risk</td><td>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.</td></tr>
</table>
Frank Knight is of the opinion that profit is the reward for bearing uncertainties. 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.</td>
</tr>
<tr>
<td>Innovation</td>
<td>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. The entrepreneurs promote economic growth of the country by introducing new innovations from time to time and contributing to technological progress.</td>
</tr>
</table>

Enterprise's objectives and constraints

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.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

→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.

→**Marris Theory of Firm's Growth:** 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.

→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.

Economic Objectives

→The profit maximising behaviour of the firm has been the most basic assumption made by economists. Under this assumption, the firm determines the price and output policy in such a way as to maximise 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.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

→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 perquisites of employees can come only out of profits.

Meaning of Profit in Economics

→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 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.

Concept of Normal Profit and Super profit in Economics

→**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.

Criticism of this objective

Profit maximisation objective has been criticised because all firms do not aim to maximise profits. Example: Some firms try to achieve Security with a reasonable level of profit;Some firms may try to maximise sales; Some economists point that owners and managers of a company try to maximise their utility rather than profit

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

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 like 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.

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 a 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 acting for 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.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

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.

Conflict between various Objectives

Various objectives of an enterprise may conflict with one another. **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 environmental pollution. In such situations, the manager has to strike a balance between the two so that both can be achieved with reasonable success.

Constraints of an enterprise in achievement of Objectives

In the pursuit of the above objectives an enterprise's action may get constrained in following ways:

→Lack of knowledge and information about many variables that affect business.

→Constraints may be experienced due to governments' restrictions on the production, price and movement of factors.

→There may be infrastructural bottlenecks.

→Changes in business and economic conditions; change in government policies about location, prices, taxes, etc.; natural calamities like fire, flood, famine, etc.

→Constraints are also faced due to inflation, rising interest rates, unfavourable exchange rate, capital and labour costs, etc.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

Enterprise's Problems

➤***Problems relating to objectives*** *The problem is that these objectives are multifarious and very often conflict with one another. 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.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 decisions on the nature of production process to be employed and the type of equipment to be installed. The choice of the process and equipment 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, specialised and complicated machinery and processes. Quite often, the entrepreneur has to choose from among different types of equipment 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.*

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

➤**Problems relating to Finance** An enterprise has to undertake not only physical planning but also expert financial planning which involves:

- determination of the amount of funds required for the enterprise with reference to the physical plans already prepared.
- assessment of demand and cost of its products.
- 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
- 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 specialised 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 lifetime and its closure. These formalities relate to assessing and paying different types of taxes like 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 the government. 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. 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.

PRODUCTION FUNCTION

Meaning of Production Function

Output is a function of inputs i.e., factor services such as land, labour and capital which are used in production. In other words, production is a transformation of physical input into physical output.

→**The functional relationship between physical inputs and physical output, per unit of time under a given state of technology is called production function.** It can also be expressed in the form of a mathematical equation in which output is the dependent variable and input is the independent variable. $Q = f(a, b, c, n)$

Where,

Q=quantity of output of a commodity per unit of time

f stands for function of i.e. depends on a, b, c,... n denotes quantity of various inputs

CHAPTER 3: THEORY OF PRODUCTION AND COST

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.

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 utilisation 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.
- It can also be defined as the minimum quantities of various inputs that are required to yield a given quantity of output. 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 v/s Long run Production function

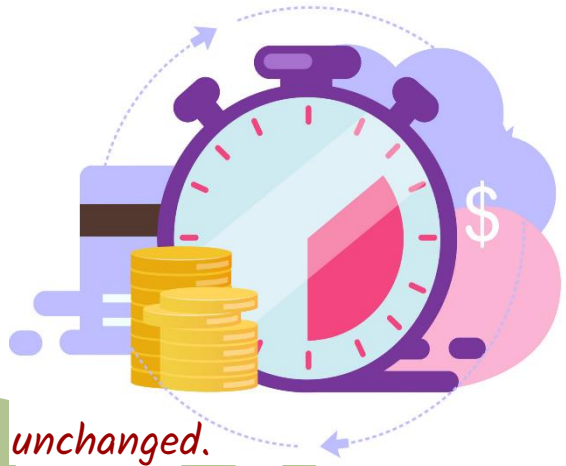
→The production function of a firm can be studied in the **context of a short period or long period.**

→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, Example: 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.

CHAPTER 3: THEORY OF PRODUCTION AND COST

Short Run period



→A period will be considered a short-run period if the amount of at least one of the inputs used remains unchanged during that period. Thus, the 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 unchanged.

→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.

Long run Period

→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 equipment 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.

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

W.Cobb and Paul H.Douglas

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

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

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.

Law of Variable Proportions or The Law of Diminishing Returns

---

→There are three concepts relating to the physical production by factors namely-

1. Total Product **(TP)**,
2. Average Product **(AP)**, and
3. Marginal Product **(MP)**.

Total Product

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.

Average Product

The average product means the total product per unit of a variable factor. In other words, it is the total product divided by the number of units of a variable factor.

$$Average\ Product = \frac{Total\ Product}{No.of\ units\ of\ variable\ factor}\ OR\ AP = \frac{TP}{QVF}.$$

Marginal Product

The marginal product means addition made to the total product by the use of an extra unit of variable factor. It may be stated as: $MPn = TPn - TPn - 1$.

Where, MPn = Marginal product when 'n ' units of variable factors are used

TP = Total Product

n = number of units of variable factors used.

Marginal Product may also be defined as the change in total output due to use of an additional unit of variable factor. $MP = \frac{\Delta TP}{\Delta QVF}$.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

Law of Variable Proportions

→The Law of Variable Proportions examines the production function i.e., the input-output relation in short run where one factor is variable and other factors of production are fixed. In other words, it examines the production function when the output is increased by varying the quantity of one input.

→Thus, the law examines the effect of change in the proportions between fixed and variable & factor inputs on output in three stages viz. Increasing returns, diminishing returns and negative returns.

→"As the proportion of one factor in a combination of factors is increased, after a point first the marginal and then the average product of that factor will diminish" **F. Benhan.**

Assumptions Law of Variable Proportions

→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.

→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.

→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.

→We consider only physical inputs and outputs and not economic profitability in monetary terms.

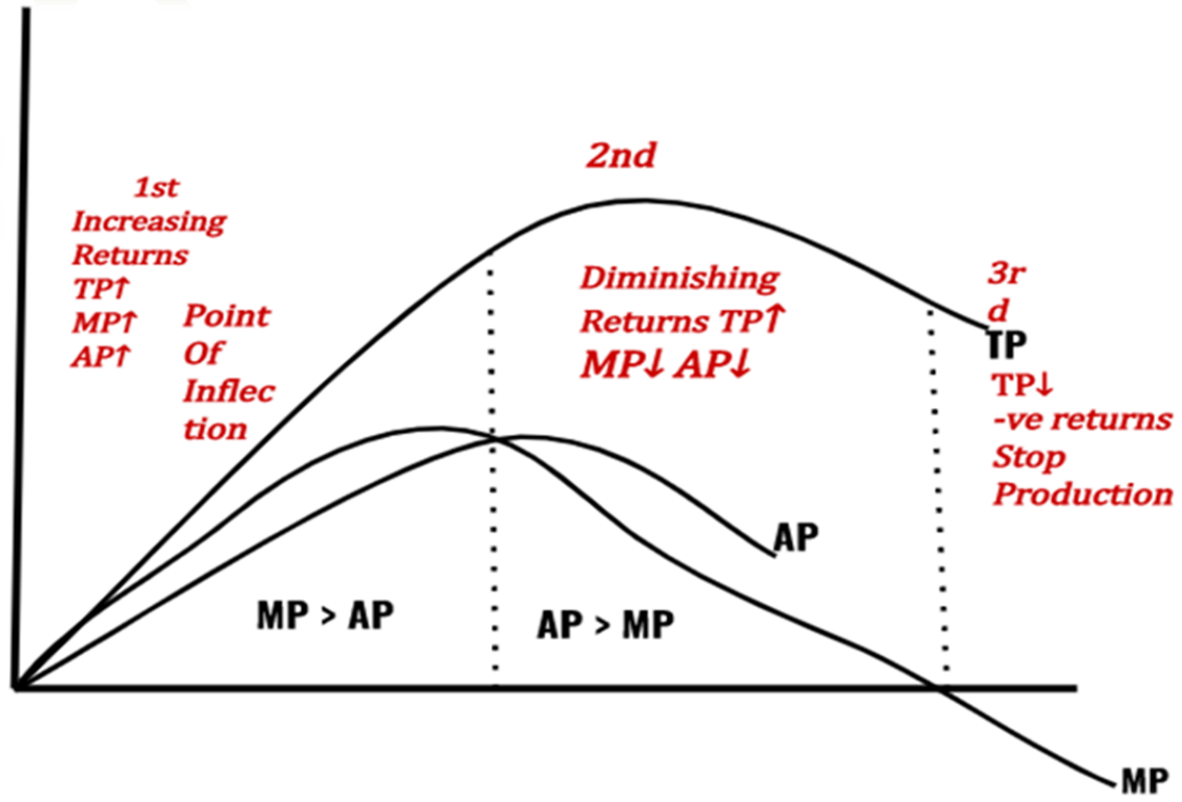
CHAPTER 3: THEORY OF PRODUCTION AND COST

Product Schedule

Quantity of labour	Total Product (TP)	Average Product (AP)	Marginal Product (MP)
(1)	(2)	(3)	(4)
1	100	100.0	100
2	210	105.0	110
3	330	110.0	120
4	440	110.0	110
5	520	104.0	80
6	600	100.0	80
7	670	95.7	70
8	720	90.0	50
9	750	83.3	30
10	750	75.0	0
11	740	67.3	-10

Relationship between AP and MP

- Both AP and MP can be calculated by TP.
- When AP rises then MP also rises but MP >AP.
- When AP is maximum then MP =AP or say MP curve cuts the AP curve at its maximum point
- When AP falls then MP also falls but MP <AP.
- There may be a situation when MP decreases and AP increases but the opposite never happens.



THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

Stage 1: Increasing returns to Factor: The law of increasing returns operates because of indivisibility of fixed factors. It means, in order to produce goods up to a given limit, at least one unit of the fixed factor is a fixed. Increasing returns in the initial stages is that with sufficient quantity of variable factor, introduction of division of labour and specialisation becomes possible, which results in higher productivity. Point of Inflexion is that point on TP at which MP is maximum

Stage 2: Diminishing Returns to Factor: Once the point is reached at which the amount of variable factor is sufficient to ensure the 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 variable factors. Another reason offered for the operation of the diminishing returns is the imperfect substitutability of factors for one another. Saturation point is that point at which TP is maximum and MP is zero.

Stage 3: Negative Returns to Factor: In this stage the quantity of variable factor becomes too excessive relative to the fixed factor so that they get in each other's way 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.

Producer achieve equilibrium

→Rational producers will never produce in stage 3 where the marginal product of the variable factor is negative. This being so, a producer can always increase his output by reducing the amount of variable factors. 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 nonsense'.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

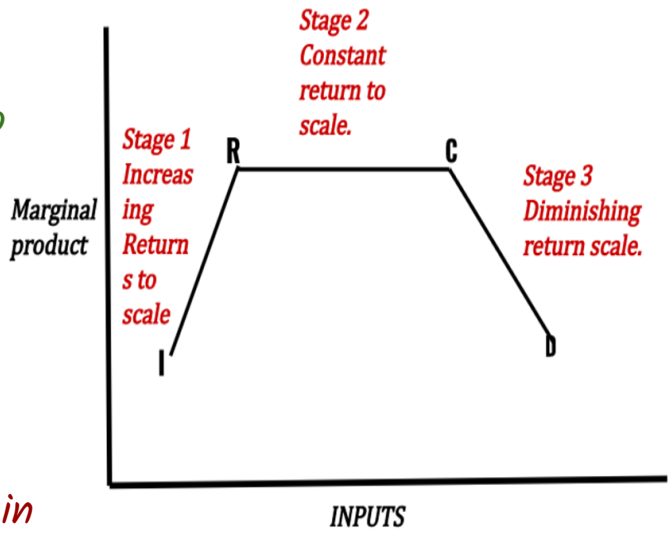
→A rational producer will always produce in stage 2 where both the marginal product and average product of the variable factors are diminishing. At which particular point in this stage, the producer will decide to produce depending upon the prices of factors.

Law of Returns to Scale

The Law of Returns to Scale examines the production function i.e. the input - output relation in the long run where increase in output can be achieved by varying the units of all factors in the same proportion. Thus, in the long run all factors become variable. It means that in the long run the scale of production and the size of the firm can be increased.

The law of returns to scale analyse the effects of scale on the level of output as-

1. Increasing Returns to Scale: When the output increases by a greater proportion than the proportion increases in all the factor inputs, it is increasing returns to scale. The reasons for increasing returns to scale are internal and external economies of scale; indivisibility of fixed factors; improved organisation; division of labour and specialisation; better supervision and control; adequate supply of productive factors, etc.



2. Constant Returns to Scale When the output increases exactly in the same proportion as that of increase in all factor inputs, it is constant returns to scale. The reason for constant returns to scale is that beyond a certain point, internal and external economies are neutralised by growing internal and external diseconomies. Constant returns to scale, otherwise called as "Linear Homogeneous Production Function", may be expressed as follows: $kQx = f(kK, kL) = k(K, L)$. 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.

3. Diminishing Returns to Scale When the output increases by a lesser proportion than the proportion increase in all the factor inputs, it is diminishing returns to scale. The reason for diminishing returns to scale is increased internal and external diseconomies of production. Internal diseconomies like difficulties in management, lack of supervision and control, delay in decision-making

etc. External diseconomies like insufficient transport system, high freight rates, high prices of raw materials, power cuts, etc.

→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: $Q = KL^a\ C^b$

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).
- If a + b = 1 Constant returns to scale result i.e. the output increases in the same proportion in which factors are increased.
- If a + b < 1 decreases returns to scale result i.e. the output increases less than the proportionate increase in the labour and capital.

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.

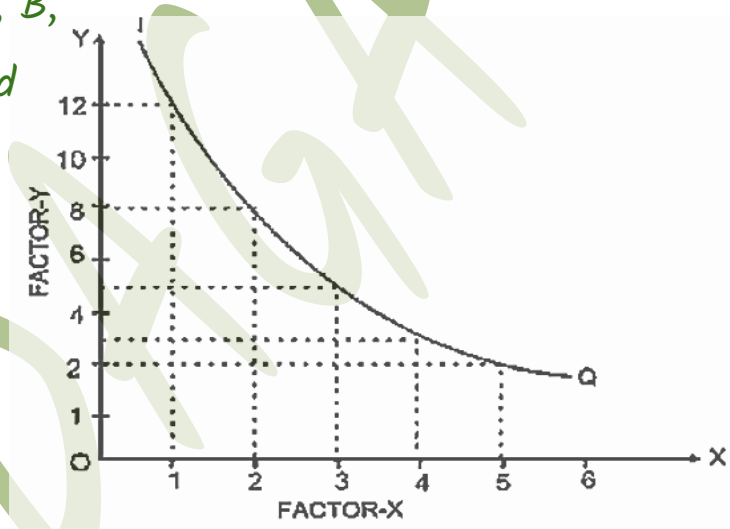
Isoquants

An iso-product curve or isoquant is a curve, which represents the various combinations of two variable inputs that give the same level of output. As all combinations on the iso-product curve give the same level of output, the producer becomes indifferent to these combinations. That is why iso-product curves are also called 'production indifference curve' or 'equal product curve'. To understand, consider the following production isoquant schedule.

CHAPTER 3: THEORY OF PRODUCTION AND COST

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

The producer is indifferent whether he gets a combination A, B, C, D or E. This is because all the combinations of capital and labour give the same level of output. By plotting the above combinations on a graph, we can derive an iso-product curve as shown in the following figure.



In the diagram, the quantity of capital is measured on the X-axis and quantity of labour on the Y-axis. The various combinations A, B, C, D, E of capital and labour are plotted and on joining them we derive an iso-product curve. All combinations lying on the iso-product curve yield the same level of output and hence technically equally efficient. A set of iso-product curves is called an iso-product curve map.

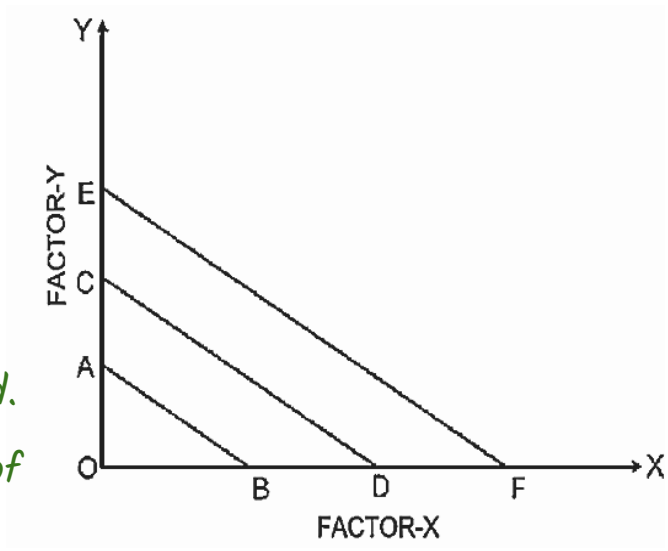
Marginal Rate of Technical Substitution

The rate at which one factor of production is substituted in place of the other factor without any change in the level of output is called the marginal rate of technical substitution.

Each of the factor combinations has the same level of output. It implies that labour and capital are imperfect substitutes.

Iso-Cost Line OR Equal Cost Lines

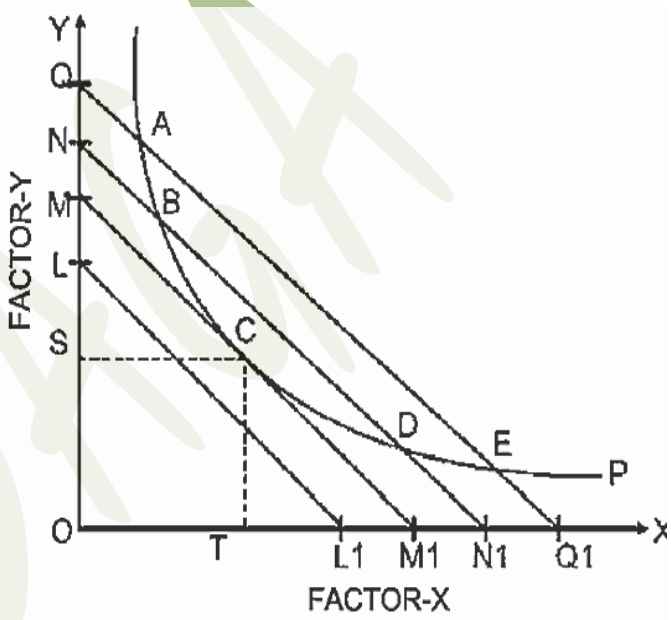
Iso-cost line also known as Equal Cost Line; Price Line; Outlay Line; Factor Price Line shows the various combinations of two factor inputs which the firm can purchase with a given outlay i.e., budget and at given prices of two inputs. The iso-cost line shifts to the right, if prices of two factors remain unchanged. The slope of the iso-cost line is equal to the ratio of the prices of



CHAPTER 3: THEORY OF PRODUCTION AND COST

two factors. Thus, $PM = \frac{Price\ of\ X}{Price\ of\ Y}$

Producer's Equilibrium OR Production Optimization



A firm always tries to produce a given level of output at minimum cost. For this it has to use that combination of inputs which minimises the cost of production. This ensures maximisation of profits and produces a given level of output with the least cost combination of inputs. The least-cost combination of inputs or factors is called producer's equilibrium or production optimization. This is determined with the help of (a) isoquants, & (b) iso-cost line. An isoquant or iso-product curve is a curve which shows the various combinations of two inputs that produce the same level of output. The isoquants are negatively sloped and convex to origin. The slope of isoquants shows the marginal rate of technical substitution which diminishes. Thus, MRSxy =Slope=$\frac{\Delta y}{\Delta x} = \frac{MPx}{MPy}$.

The point of tangency of isoquant and iso-cost line shows least cost combination. At the point of tangency. Slope of iso-quant = Slope of iso-cost line.

CHAPTER 3: THEORY OF PRODUCTION AND COST

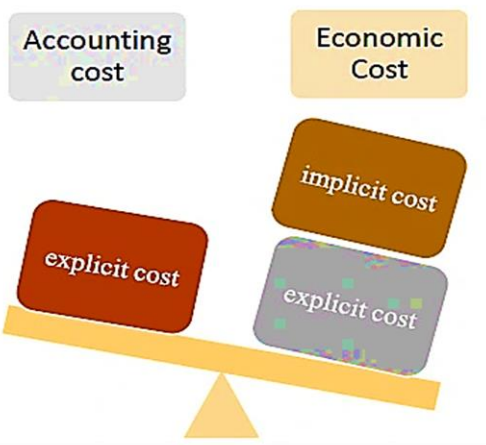
Unit 2: Theory of Cost

In the production analysis we considered the quantitative relationship between inputs and outputs. In the cost analysis we are concerned with the financial side of production i.e. the cost behaviour in relation to size of output, scale of operations, prices of factors of production,etc. Therefore, a businessman must have a clear understanding of various concepts of costs.

COST CONCEPTS

Accounting Costs and Economic Costs

Accounting costs: *These are those cash payments which firms make to outsiders for purchasing or hiring the services of various productive factors which do not belong to the entrepreneur.*



→The accounting costs are in the nature of contractual payments to the factor suppliers. Contractual payments Example: wages, rent on hired land, interest on borrowed capital, cost of power and fuel, purchase of raw-materials, insurance premium, transportation, advertising, taxes, etc. These costs are recorded in the firm's account book.

*→All these money expenses are **also known as explicit costs** or accounting costs as they form part of the cost of production and are accounted for by the firm.*

Economic Costs: *Economists take a broader view of the cost concept. Economist's cost refers to what may be called **full costs or economic costs.***

*→**Economic Costs** = Explicit costs (or accounting costs) + Implicit costs (or imputed costs). Thus, economic cost is the sum total of accounting costs (also called explicit costs) and implicit cost (also called imputed costs or opportunity cost). Implicit costs are costs of self owned and self supplied resources by an entrepreneur which are generally not recorded in the firm's account book.*

→There is no contractual obligation for payment to anybody else. Example: An entrepreneur may utilise his own building or his own capital or may act as a manager of his firm himself. For these productive services, he does not pay rent or interest or salary to himself although the payments

accrue to him. When an entrepreneur invests capital in his business, devotes his time and skills in his business, he has to forego the opportunity of investing his capital, time and skills elsewhere.

→Implicit costs involve the sacrifice of alternatives that have been foregone in the production of a commodity. Hence, implicit costs are also called "opportunity cost" and form part of the economic costs.

→A firm earns economic profits or normal profit when it recovers both explicit costs as well as implicit costs. Thus, normal profit is a part of implicit cost. Profit earned over and above normal profit is called super normal profit.

Outlay Cost and Opportunity Cost

→**Outlay costs** involve actual outlay of funds on wages, material, rent, interest etc. Outlay costs involve financial expenditure at some time and thus are recorded in the books of account.

→Our wants are unlimited and resources are scarce but have alternative uses. Hence, the problem of choice among the alternative uses of a given resource for particular purposes arises. This is because the use of a resource in producing a commodity always involves the loss of opportunity of production of some other commodity. The sacrifice or loss of alternative use of a given resource is termed as " **opportunity cost.**"

Thus, the opportunity cost is measured in terms of the foregone benefits from the next best alternative use of a given resource. Hence, opportunity costs relate to sacrificed alternatives that are not recorded in the books of account. The concept of opportunity cost is useful in the determination of relative prices of goods, normal remuneration to a factor, in decision making and in analysing optimum allocation of resources.

Direct or Traceable Costs and Indirect or Non-Traceable Costs

Direct Costs: A direct or traceable cost is one which can be identified easily and indisputably with a unit of operation.

Example: a product, a department, a plant or a process, In the production of shoes, the cost of leather is a direct cost.

CHAPTER 3: THEORY OF PRODUCTION AND COST

Indirect Cost: *Indirect Costs or Non-Traceable Costs or Common Costs are those costs that are not traceable to plant, department and operation as well as those that are not traceable to individual final products but are charged to jobs or products in standard accounting practice. Such costs, although not directly traceable to the product, may bear some functional relationship to production and may vary with output in some definite way. Example: electric power. Such common costs which are incurred for general operation of business and benefits all products jointly are called indirect costs.*

Incremental costs and Sunk Costs

→**Incremental costs** *are related to the concept of marginal cost. While marginal cost refer to additional cost of producing an extra unit of output, incremental cost refers to the total additional cost when business decisions are taken like-to expand the production, hire more workers, materials, machinery, equipment, replace old plant and machinery, etc.*

→**Sunk costs** *refer to the costs which have been already incurred in the past and cannot be recovered. It also includes an expenditure that has to be made in future under past commitments or contractual agreements. Sunk costs are irrelevant for decision making as it cannot be recovered. Sunk costs do not vary with the changes in business activity.*

Such costs also act as an important barrier to entry of firms into business. Example: expenses on advertising, R&D, special equipment, etc.

Historical costs and Replacement costs

→*Historical costs are those costs on purchase of assets in the past.*

→*Replacement costs refer to the expenditure to be made for replacing old assets. Instability in asset prices make the two costs differ.*

CHAPTER 3: THEORY OF PRODUCTION AND COST

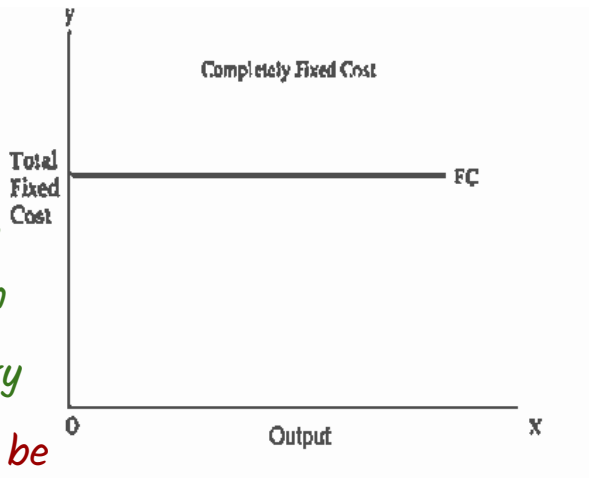
Private costs and Social costs

Private costs are those costs which are incurred or provided for by firms. These may be either explicit or implicit since they form part of total cost of production, it implies they figure in business decisions. Therefore, private costs are internalised costs.

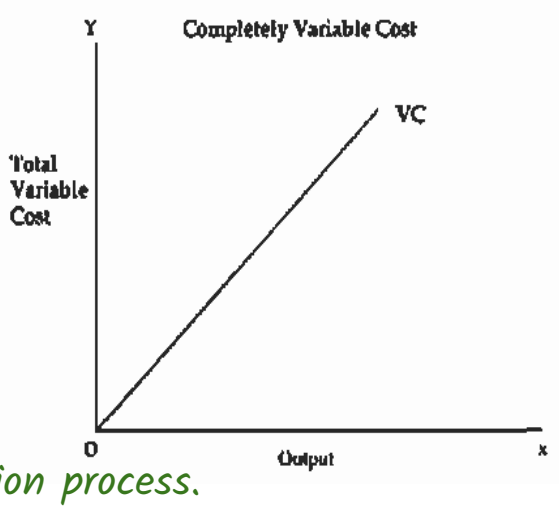
Social costs refer to the total cost to the society due to business activity. Social costs include both private costs and external costs. It includes resources for which the firm is not required to pay the price. Example: atmosphere, rivers, lakes, roads, etc. and the cost in terms of disutility created like pollution of all types.

Fixed and Variable costs

Fixed or constant costs are not a function of output; they do not vary with output up to a certain level of activity. These costs require a fixed expenditure of funds irrespective of the level of output, Example: rent, property taxes, interest on loans and depreciation when taken as a function of time and not of output. Fixed costs do not vary with the volume of output within a capacity level. Fixed costs cannot be avoided. They can be avoided only when the operations are completely closed down. These are, by their very nature, inescapable or uncontrollable costs. Example: for storing of old machines which cannot be sold in the market. These are called **shut down costs**. Some of the fixed costs such as costs of advertising, etc. are programmed fixed costs or discretionary expenses, because they depend upon the discretion of management whether to spend on these services or not.



Variable costs are costs that are a function of output in the production period. Example: wages of casual labourers and cost of raw materials and cost of all other inputs that vary with output are variable costs. Over certain ranges of production, they may vary less or more than proportionately depending on the utilisation of fixed facilities and resources during the production process.

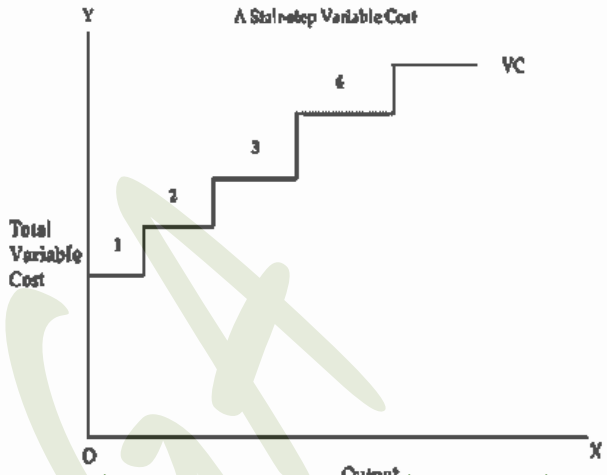


THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

Semi Variable Cost

There are some costs which are neither perfectly variable, nor absolutely fixed in relation to the changes in the size of output. They are known as semi-variable costs. Example: Electricity charges include both a fixed charge and a charge based on consumption. There are some costs which may increase in a stair-step fashion, i.e., they remain fixed over a certain range of output; but suddenly jump to a new higher level when output goes beyond a given limit. Example: Costs incurred towards the salary of foremen will have a sudden jump if another foreman is appointed when the output crosses a particular limit.



COST FUNCTION

Cost function is the functional relation between costs and output. Production Function of a firm and the Prices it pays for the inputs determine the firm's cost function. Thus, cost function refers to the relation between cost of a product and the various determinants of its cost. It can also be expressed in the form of a mathematical equation in which unit cost or total cost is the dependent variable and the prices of various inputs are independent variables.

$C = f(O,S,T,U,P\_\_\_)$

Where,

C is cost

O is the level of output

S is the size of plant

T is time under consideration

P is the price of factors of production.

→Production function determines the cost function. Therefore, the behaviour of cost of production and the shapes of the cost curves depend upon the laws of returns.

→The Law of Returns to factor determine the shapes of short-period cost curves while the Law of Returns to Scale determine the shapes of long-period cost curves. Short Run Total Costs: Total Cost(in short run) = Total Fixed Cost + Total Variable Cost.

CHAPTER 3: THEORY OF PRODUCTION AND COST

Relationship between TFC, TVC and TC

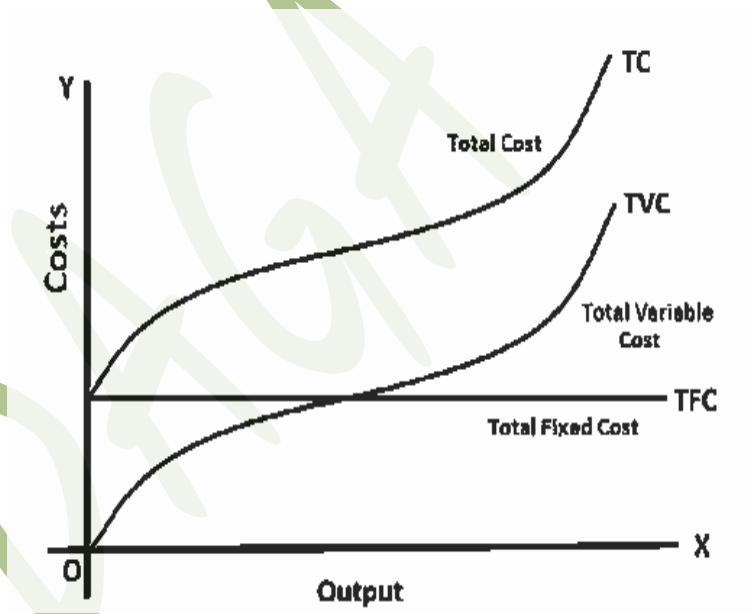
→Graphically, the TFC curve is a horizontal straight line parallel to the X- axis. It indicates that fixed cost remains unchanged at all levels.

→The TFC curve originates from the Y- axis indicating that fixed cost is to be borne even at zero level of output.

→Hence, at zero output TC is not zero. It equals TFC.

→Graphically, the TVC curve is positively sloped. It indicates that variable cost increases with the increase in output.

→TVC curve originates from 0 i.e. origin indicating that Variable cost is zero at zero level of output.

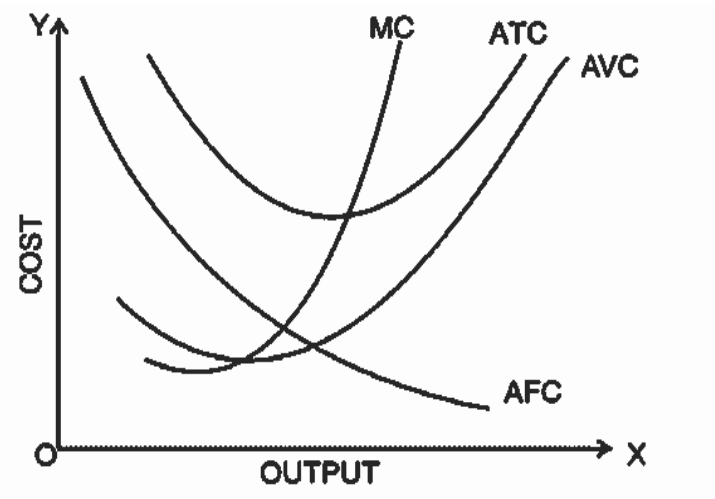


→TC reflects the behaviour of TVC. Hence, the shape of TC resembles TVC. TC cost starts from the Y axis because even when the output is Nil, TC is equal to TFC at that point. TC curve remains parallel to TVC Curve since their distance TFC Curve remains constant throughout.

Short run average cost

For the purpose of making decisions about operations, unit cost functions or average costs are more useful than the total cost functions. We examine here three of these unit cost functions namely:

- Average Fixed Cost (AFC),
- Average Variable Cost (AVC),
- Average Total Cost (ATC).



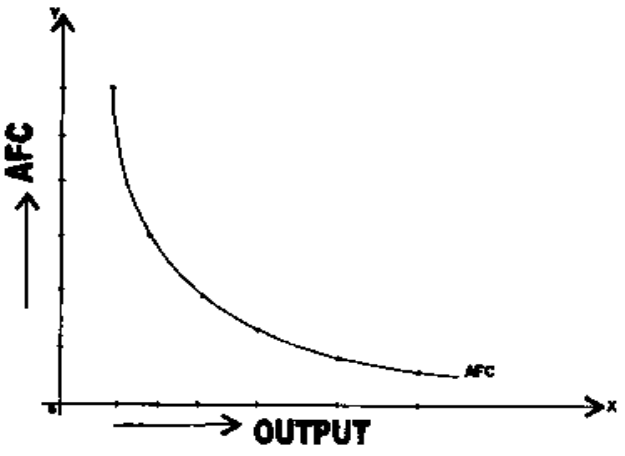
CHAPTER 3: THEORY OF PRODUCTION AND COST

Average Fixed Cost

→Average Fixed Cost is the fixed cost per unit of output.

→Thus, Average Fixed Cost = $\frac{Total\ Fixed\ Cost}{Total\ Output}$ OR $AFC = \frac{TFC}{Q}$.

→The output increases, AFC goes on falling. The reason being TFC is spread over larger quantities of output. The AFC curve slopes downwards from left to right throughout its length.



→The AFC curve comes closer and closer to the X-axis but does not touch the X-axis as AFC can never be zero. AFC the curve will not touch the Y-axis also because at zero level of output.

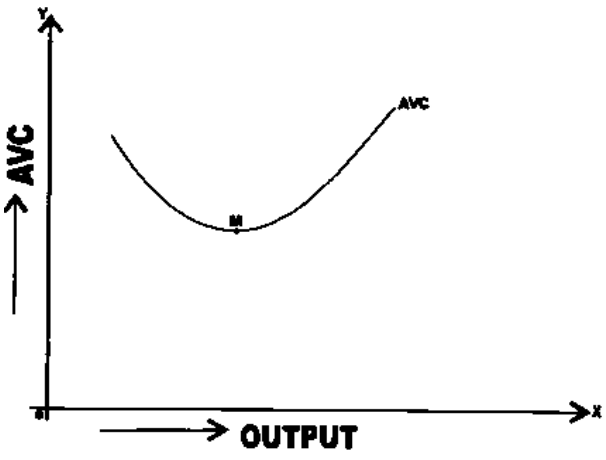
→AFC is a Positive Value. Any positive value divided by zero will provide infinite value. The AFC curve is a RECTANGULAR HYPERBOLA.

Average Variable Cost

→Average variable Cost is the variable cost per unit of output.

→Thus,Average variable Cost = $\frac{Total\ Variable\ Cost}{Total\ Output}$ OR $AVC = \frac{TVC}{Q}$

→The output expands, average variable cost falls initially due to increasing returns to the variable factor. It is minimum at the optimum capacity output. Beyond optimum capacity average variable cost rises very sharply due to diminishing returns to variable factors.



→Thus, AVC and AVERAGE PRODUCT of variable factor are inversely related. When graphed, AVC curve declines over some range of output, reaches the minimum at optimum capacity, as at point 'M' in the above diagram and then goes on rising as output increases. Thus, the AVC curve is U-shaped indicating three phases: decreasing phase, constant phase and increasing phase corresponding to the three phases of AVERAGE PRODUCT of variable factor in the law of Variable Proportions.

CHAPTER 3: THEORY OF PRODUCTION AND COST

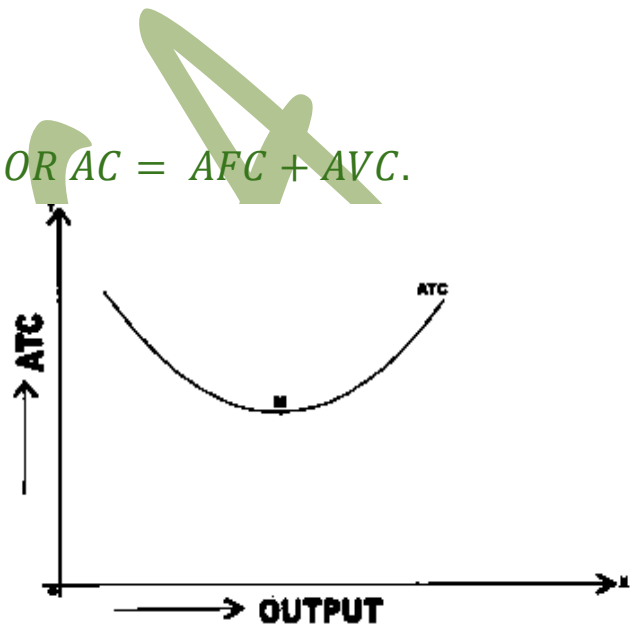
Average Total Cost

→Average Total Cost is the cost per unit of output. Thus,

→Average Total Cost or Average Cost =

$$\frac{Total\ Cost}{Total\ Output}\ OR\ ATC/AC = \frac{TC}{Q}.OR\ AC = \frac{TFC}{Q} + \frac{TVC}{Q}\ OR\ AC = AFC + AVC.$$

→As output increases, ATC falls initially, reaches its minimum and then rises due to the Law of variable proportions.



→The behaviour and shape of the ATC curve depends upon the behaviour of AVC curve and AFC curve.

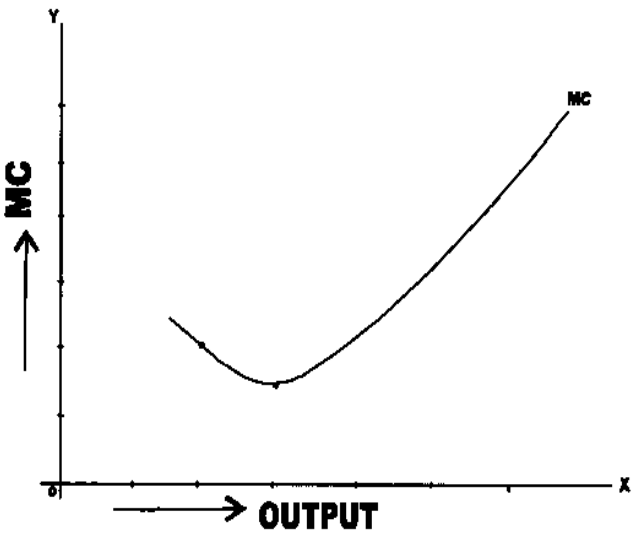
→AVC is a 'U'-shaped curve.

→In the beginning, the ATC curve falls sharply when output expands reason being, initially both AVC and AFC curves fall.

→When the AVC curve starts rising, but the AFC curve continues to fall steeply, the ATC will continue to fall reason Fall in the AFC curve is more than the Rise in AVC curve. As output further increases, the ATC curve rises, there is a sharp rise in AVC which offsets the fall in AFC. Thus, ATC curves first fall, reach its minimum and then rise.

Marginal Cost

→Marginal Cost is addition to the total cost caused by producing one more unit of output. Thus, marginal cost is the cost of the additional unit of output. It is measured by the change in total cost resulting from a unit increase in output.



→Thus, $MCn = TCn - TCn - /OR\ MC = \frac{\Delta TC}{\Delta Q}$

→The Marginal Cost is Independent of fixed cost. In the short period, total fixed costs are constant for all levels of output. The only change in total cost when output changes is Change in Variable Cost. Hence, marginal cost is affected only by the variable cost.

→Therefore, marginal cost can also be defined as a change in TVC as a result of a unit change in output. This can be proved as follows -

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

MCn = TCn – TCn-1 since, TC = TFC + TVC

MCn = (TVCn + TFCn) - (TVC n-1 + TFCn-1)

= TVCn + TFCn - TVC n-1 + TFCn-1

= TVCn –TVCn-1

→The output increases, MC initially falls due to increasing returns to factor but finally MC rises due to diminishing returns. Thus, marginal cost is the inverse of the marginal product of the variable factor. When graphed, the MC curve first declines, reaches minimum and then goes on rising as output increases. Thus, the MC curve is U - shaped, this is due to the operation of the law of returns to factor and due to TC or TVC (AC or AVC).

→MC curve passes through the minimum points of AVC and ATC curves. The MC curve reaches its minimum point earlier to the minimum points of AVC and ATC curves.

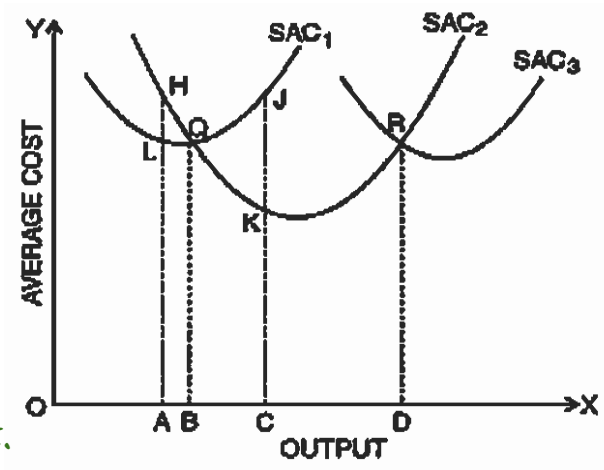
Relationship between Average Cost and Marginal Cost

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

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

LONG RUN AVERAGE COST CURVE

→Long run is a period of time during which the firm can vary all inputs. In the short run we have seen that some inputs are fixed and others can be varied to increase the level of output. But in the long run all inputs are variable. In the short run, the size of the plant is fixed. The size of the plant cannot be increased or reduced. However, in the long run the firm has sufficient time to bring about changes in the size of the plant i.e. machinery building etc. in order to expand or contract output.

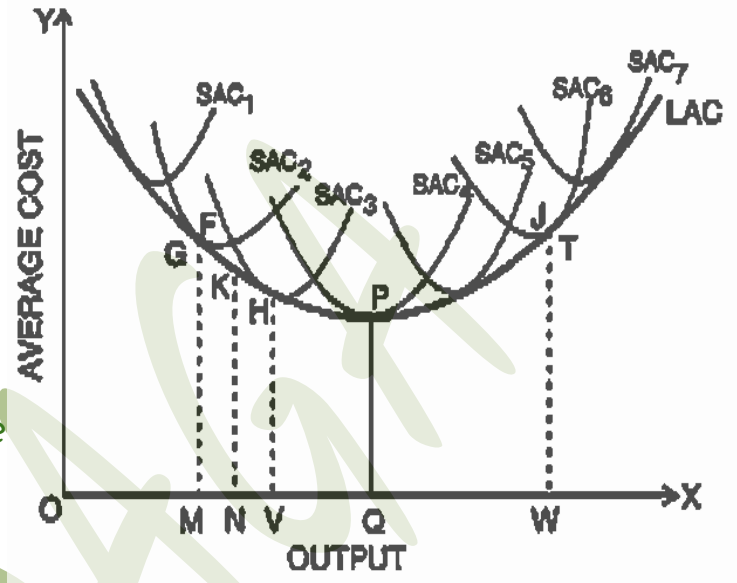


THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

→Thus, in the long run the firm moves from one plant to another.

It can increase the size of a plant to increase its output or can have a smaller plant if it has to reduce output. The long run average cost curve shows the minimum possible average cost for producing various levels of output.



→The LAC curve envelopes infinite short run average cost curves each representing a plant. Hence, SACs are also called plant curves. The LAC curve is derived as a tangent to all the short run average cost curve from SAC, to SAC7.

Thus, it is U- shaped.

→In the long run, a firm can produce a particular output by building a relevant size of plant and operate on the corresponding SAC. It selects that size of plant i.e. SAC which gives the lowest cost of producing the given output.

➔ **The LAC curve is not tangent to the minimum points of the SAC curves.**

- When the LAC curve is sloping downwards, it is tangent to falling portions of SACs.
- When the LAC curve is rising upwards, it is tangent to rising portions of SACs.

➔ **The LAC curve is also called the planning curve.**

This is because a firm plans output in the long run but operates in the short run i.e. by choosing a plant on LAC corresponding to the given output. Thus, LAC helps the firm to make a choice about the size of plant for producing a particular output at minimum cost.

➔ **LAC Curve is also called Envelope Curve**

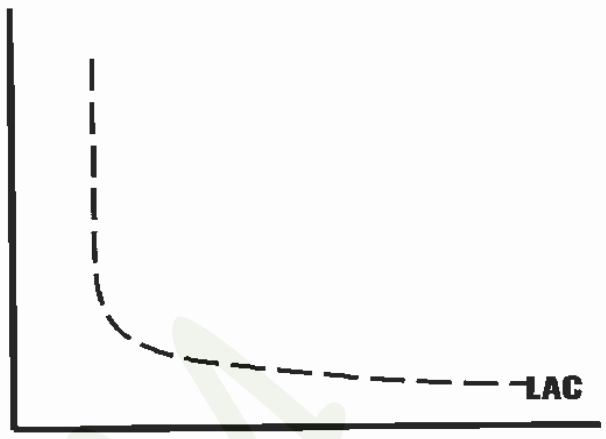
The long-run average cost curve is also called "Envelope curve", because it envelopes or supports a family of short run average cost curves from below.

→The shape of the LAC curve depends on the Law of Returns to Scale. As the firm expands, there is increasing returns to scale which means fall in long run average cost due to economies of scale. When decreasing returns to scale occur it means a rise in long run average cost due to diseconomies of scale.

Modern Day Long run Cost Curves

→The above figure depicting a long-run average cost curve is arrived at on the basis of traditional economic analysis. It is flattened 'U' shaped. This type of curve could exist only when The state of

CHAPTER 3: THEORY OF PRODUCTION AND COST



technology remains constant. But, empirical evidence shows modern firms face an 'L-shaped' cost curve over a considerable quantity of output.

→The L-shaped long run cost curve implies that initially when the output is increased due to increase in the size of plant and associated variable factors, per unit cost falls rapidly due to economies of scale. The long-run average cost curve does not increase even after a sufficiently large scale of output as it continues to enjoy economies of scale.

ECONOMIES AND DISECONOMIES OF SCALE

INTERNAL ECONOMIES

Internal economies are those benefits which accrue to a firm when it expands the scale of production. Internal economies are the result of the firm's own efforts independent of the actions of other firms. These economies are particular to the individual firms and are different for different firms depending upon the size of the firm.The main types of internal economies are as follows:

Technical Economies & Diseconomies	The large scale production is associated with technical economies.As the firm increases its scale of production, it becomes possible to use better plant, machinery, equipment and techniques of production. Following are the main forms (causes/reasons) of technical economies	
	Economies of superior techniques	A large sized firm can use sophisticated and costly machines and equipment. Use of superior techniques reduces the cost of production per unit and increases aggregate output.
	Economies of increased dimensions	A large firm can get the mechanical advantage in using large machines and other mechanical units to produce more output.
	Economies of linked processes	A large sized firm can develop its own sources of raw material, means of transportation,distribution system, etc.
	Economies of the use of By-products.	A large sized firm can avoid all kinds of wastage of materials. The firm can use its by-products and waste material to produce another material.

	Economies of specialisation	*A large sized firm can introduce a greater degree of division of labour and specialisation.*
Managerial Economies	*Large sized firms can introduce division of labour in managerial tasks. They can employ business executive of high skill and qualification to look after the functioning of various departments like production, finance, sales, advertising, personnel, etc. This helps to increase the efficiency and productivity of managers resulting in reduction in managerial costs*	
Commercial Economies	*A large sized firm is able to reap economies of bulk purchases. It can get discounts from suppliers, railways, transport companies, etc. It enjoys prompt and regular supply of raw materials. A large sized firm can also afford to spend large amounts of money on advertising, publicity, etc. It can also give various concessions to wholesale and retail dealers and customers and thus capture markets for its product*	
Financial Economies	*A big firm enjoys goodwill among lenders or investors. For raising finance it can either borrow from banks as it can offer better security or it can raise finance by issuing shares, debentures and by inviting public deposits. Such opportunities are not available to small firms.*	
Risk Bearing Economies	*A large firm is better placed to face the uncertainties and risks of business. A big firm producing many varieties of goods is in a better position to withstand economic ups and downs. Therefore, it enjoys economies of risk bearing.*	

INTERNAL DISECONOMIES

Internal diseconomies means all those factors which raise the cost of production per unit of a particular firm when the scale of production is expanded beyond the point of optimal capacity. Such diseconomies of scale are as follows:

Production Diseconomies	*Production diseconomies set in when expansion of a firm's production beyond optimum size leads to rise in the cost per unit of output.*
Managerial Diseconomies	*As the scale of production increases, the burden on management also increases. Coordination of work among different departments becomes difficult. Supervision and control over the activities of subordinates becomes difficult, decision taking is delayed, etc.- As a result, wastage increases and the efficiency and productivity decrease Per unit cost starts rising*

CHAPTER 3: THEORY OF PRODUCTION AND COST

Technical Diseconomies	Every equipment has an optimum point at which it works more efficiently and economically. Beyond optimum point they are overworked and may result in breakdowns, heavy cost of maintenance, etc.
Financial Diseconomies	Expansion of production beyond the optimum scale results in increase in the cost of capital. It may be due to increased dependence on external finances.
Marketing Diseconomies	Selling diseconomies set in if the scale of production is expanded beyond optimum level. The advertisement expenditure and marketing overheads increase more proportionately with the scale

EXTERNAL ECONOMIES

External economies are those benefits which accrue to all the firms operating in a given industry from the growth and expansion of that industry. External economies are not related to an individual firm's own cost reduction efforts. These are common to all the firms in an industry and shared by many firms or industries. The main types of external economies are as follows:

Technological Economies	When the whole industry expands, it may result in the discovery of new technical knowledge, firms pool manpower and finance for research and development resulting in new and improved methods of production and new inventions. Use of improved and better machinery improves production function and cost of production per unit fails.
Economies of Localization	When in an area, many firms producing the same commodity are set up, it is called localization of an industry. Due to localization there is expansion of railways, post & telegraph, banking services,insurance, setting up of booking offices by transport companies, setting up of powerful transformers by the electricity department, etc. All the firms get these facilities at low prices.
Economies of Information	As pointed earlier, firms pool their resources for research and development.All firms get the benefit of the research in terms of market information, technical information, information about governments economic policies, information about availability of new sources of raw material, etc. Also, specialised journals give information about the latest developments.

CHAPTER 3: THEORY OF PRODUCTION AND COST

Cheaper Inputs	When an industry expands its needs for raw materials, machines, etc. also expand. This may result in exploration of new and cheaper sources of raw materials, machinery, etc. Also, the industries producing such inputs also expand in scale. Therefore, they can supply these inputs at lower prices. As a result the cost of production per unit of the firm using these inputs falls.
Growth of Ancillary Industries	With the growth of an industry, many firms specialised in the production of inputs like raw material, tools, machinery, etc. come up. Such firms are called ancillary units which provide inputs at lower cost to the main industry.Likewise, some firms may get developed by processing the waste products of the industry. Thus, wastes are converted into by-products. This reduces the cost of production in general
Development of Skilled Labour	When an industry expands specialised institutions like colleges, training centres, management institutes, etc. develop.This results in continuous availability of skilled labour like technicians, engineers,management experts, etc
Better transportation & Marketing Facilities	When an industry expands many specialised transporters also develop. The firm in need of specialised transport service can get them easily at cheaper rates. Also many new marketing outlets and specialised marketing institutions develop. The firm need not spend on developing its own marketing outlets.This reduces the cos

External Diseconomies

The growth and expansion of an industry in a particular area beyond optimum level results in many disadvantages for firms in the industry. Such disadvantages increase the costs of production of each firm. Therefore, they are called external diseconomies. Some of the external diseconomies are as follows:

Diseconomies of Scarcity of Inputs	When an industry expands its need for raw materials, machines, tools and equipment, etc.also expands.Some inputs are such which cannot be totally substituted.The firms supplying these inputs come under pressure and may supply inputs at a higher price.This raises the cost of production per unit of the firm who uses these inputs
Diseconomies of Strains on	Due to the concentration of firms in an area infrastructural facilities become - inadequate over time. E.g. Excessive pressure on the transport system results

CHAPTER 3: THEORY OF PRODUCTION AND COST

Infrastructure	in delayed transportation of raw materials and finished goods.Other facilities like electric power supply, communication system, water supply, etc. are also over taxed. This puts strain on infrastructural facilities resulting in increased cost of production
Diseconomies of High Factor Prices	With the concentration of an industry in a particular area, the demand for factors of production rises.Thus, the prices of the factors of production go up resulting in increased cost of production
Diseconomies Of Expenditure On Advertising	Expansion of an industry also means an increase in the number of firms. Likewise, some firms may get developed by processing the waste products of the industry.Thus, wastes are converted into by-products. This reduces the cost of production in general

SUMMARY NOTES

➢ **Inputs→ Process→ Output.**

- Production- Creation/ addition of utility.

➢ **Types of utility:**

- Form utility
- Place utility
- Time utility.

➢ **Factors of production** (land, labour, capital, Enterprise)

➔ **Land-**

- Land- free gift of nature.
- Supply of land is fixed(perfectly inelastic)
- Land is a passive factor.
- Primary factor
- Land is heterogeneous(different
- Land has multiple uses.
- Land is immovable.

➔ **Labour-**

- The term labour means any mental or physical exertion directed to produce goods or services.

CHAPTER 3: THEORY OF PRODUCTION AND COST

- In other words, it refers to various types of human affairs which requires use of physical exertion, skill and intellect.
- **Human effort** labour is **perishable**.
- labour is an **active factor** of production.
- Labour Power differs from labourer to labourer.
- All labour may not be productive.
- Labour is mobile (no per perfectly Mobile)
- Choice between hour labour and hours of leisure.
- Labour has poor bargaining power.
- There is no adjustment between supply of labour and demand for it immediately.

➔ Capital-

- Capital is different from wealth.
- Capital is a stock concept which yields a periodical income which is a flow concept.
- Capital has been rightly define as "produced means of production" or "man made instruments of production"
- Machine tools and instruments, factories, dams, canals, transport equipment etc, are some examples of capital.
- all of them are produced by man to help in the production of future goods.

➢ Types of capital

- Fixed- used over a period of time.
- Circulating - single use.
- Real- Physical goods.
- Human - skills and ability.
- Tangible - can be perceived by senses.
- Individual - personal ownership.
- Social - belongs to society.

➢ Capital formation-

- Savings
- mobilisation of savings
- Investment

➢Entrepreneur-

- Initiating business enterprise and resources co-ordination.
- risk bearing and uncertainty.
- innovations .

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

Schumpeter – *Two functions of an entrepreneur is to innovate.*

- *Initialising business enterprise and resources coordination.*
- *Ideas , opportunities, opinions.*
- *Risk*
- *Reward .*

➢ **Risk bearing and uncertainty:** *Economy is dynamic and changes occur everyday.*

- **Frank Knight** *opinion profit is reward for bearing uncertainties.*

➢**Innovations;**

- *True function of an entrepreneur is to introduce innovations.*
- *Innovation will be initiated by others*
- *Introduce innovations from time to time.*

➢ **Enterprise objectives-**

- *Organic- survival of firms is essential.*
- *Economic - profit*
- *Social - To avoid anti profiteering*
- *Human - employees .*
- *National - Help a country to become self-reliant, avoid dependence on other countries.*

➢ **Enterprise problems:**

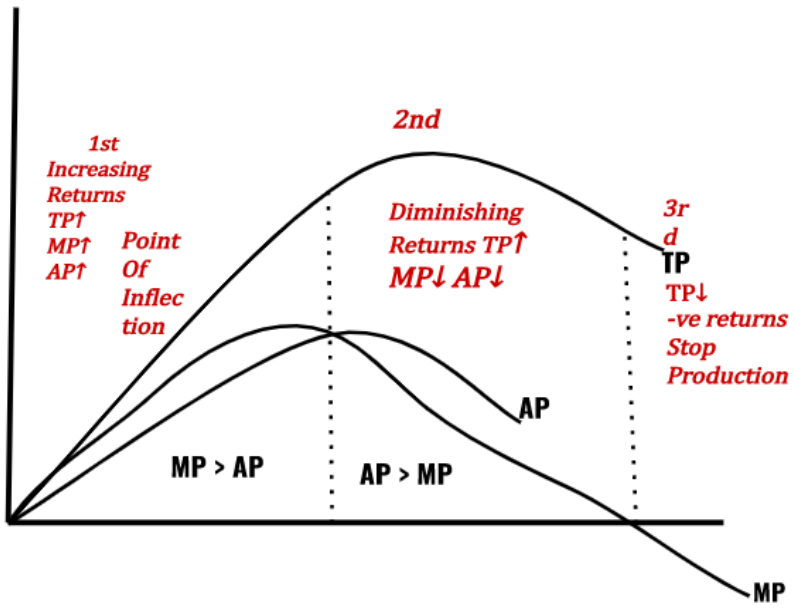
- *Problems relating to objectives*
- *problems relating to location*
- *problems relating to finance*
- *problems relating to organisation structure*
- *problems relating to marketing*
- *problems relating to legal formalities*
- *problems relating to Industrial Relations.*

➢ **Law of variable proportion-**

- *Use in short run*
- *One variable Input and all other inputs are held constant.*
- *law of returns to variable inputs*
- *law of diminishing Returns.*

CHAPTER 3: THEORY OF PRODUCTION AND COST

One variable input rest all factors are fixed:



$$AP = \frac{TP}{Q}.$$

$$MP3 = TP3 - TP2$$

$$TP = MP1 + MP2 + MP3 + \ldots\ldots\ldots$$

Product Schedule

Quantity of labour	Total Product (TP)	Average Product (AP)	Marginal Product (MP)
(1)	(2)	(3)	(4)
1	100	100.0	100
2	210	105.0	110
3	330	110.0	120
4	440	110.0	110
5	520	104.0	80
6	600	100.0	80
7	670	95.7	70
8	720	90.0	50
9	750	83.3	30
10	750	75.0	0
11	740	67.3	-10

1st	2nd	3rd
TP↑ MP↑ AP↑ (Increasing rate) MP>AP increasing returns maximum point of inflation	TP↑ MP ↓ AP ↓ (Diminishing rate) AP>MP diminishing Returns AP=MP AP is maximum	TP ↓ MP -ve negative Returns stop production
AP = MP first stage ends	producer is more happy in stage second when TP Max and MP is zero, stage second ends	

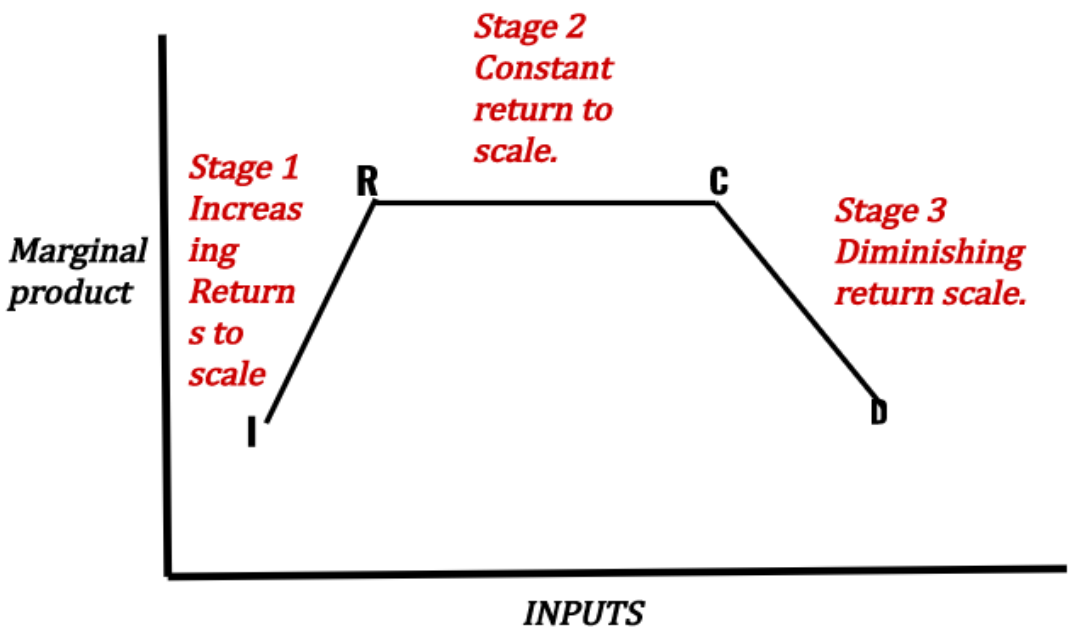
THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

Law of Return of scale

- **Long run**
  - *All the factors of production are variable*
  - *all the factors of production are either increased or decreased.*
  - *Input & output ratio*

100	*120*	*increasing returns*
100	*100*	*constant Returns*
100	*80*	*decreasing Returns.*



➢ Increasing returns to scale:

- *If we increase all the factors and give output increases in proportion this is known as increasing return to scale.*
- *When a firm expands, increasing returns are found in the beginning.*
- *This also happens due to specialisation of machinery, land, etc.*

➢ Constant returns to scale:

- *If we increase all the factors and given output increases in the same proportion this is known as constant returns to scale.*
- *It is also known as a linear Homogeneous production function.*
- *Invisible form passes through a long face of constant returns to scale.*

➢ Decreasing returns to scale:

- *If we increase all the factors and give output decrease in proportion this is known as a decreasing return to scale.*
- *When a firm expands to a very large size it is difficult to manage with the same efficiency as before.*

THE SHOW MUST GO ON!!

- difficulty in management, control.
- **Internal**

  Economics (fayda) Diseconomies (Nuksan).
- **External**

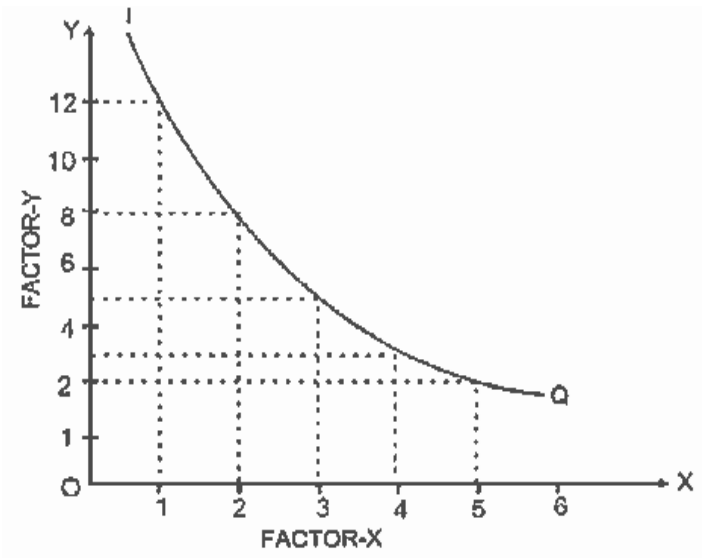
  Economics; Diseconomies.

Factor combination	scale of inputs	TP (in quintals)	MP (in quintals)
IRS	2 + 1	20	20
	4 + 2	50	30
	6 + 3	90	40
CRS	8 + 4	140	50
	10 + 5	190	50
	12 + 6	240	50
	14 + 7	290	50
DRS	16 + 8	320	30
	18 + 9	340	20
	20 + 10	350	10

- **Internal:**
  - Technical
  - Managerial
  - Commercial
  - Financial
  - Risk bearing.
- **External:**
  - Capital equipment and raw material- cheaper.
  - Technological
  - Development of skilled labour.
  - Growth of ancillary industry.
  - Better transportation and marketing facility.
  - Economics of information.

CHAPTER 3: THEORY OF PRODUCTION AND COST

➢ ISO- Quant curve-



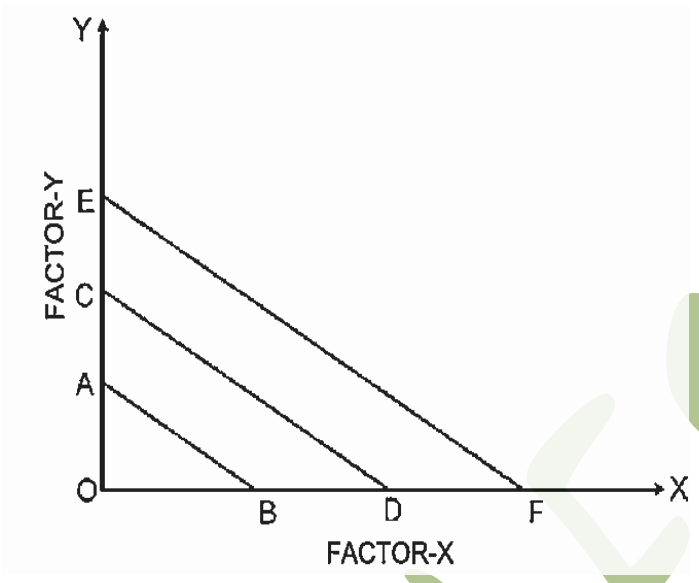
ISO- production curve.

Equal quantity of output

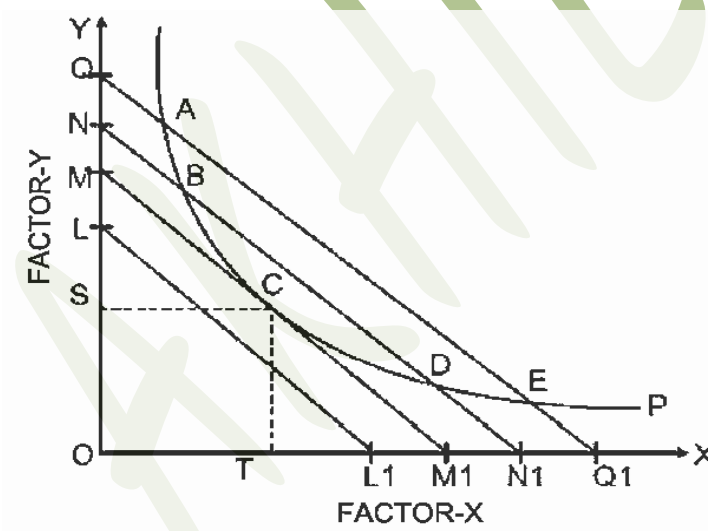
Equal product curve

Production indifference curve.

➢ ISO cost line



➢ Production Optimisation:



Producer's equilibrium.

➢ Theory of cost

- **Accounting cost-** Explicit cost

  Recorded in financial statements (payment and charges made by entrepreneur).

- **Economic cost-** explicit + implicit cost (cost of factors owner by entrepreneur)

- **Outlay cost-** actual expenditure on wages, rent, interest.

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

- **Opportunity cost-** cost on next best opportunity (subject value foregone).
- **Direct / traceable cost-** direct relation with component of operation.
  readily identified and traceable.
- **Indirect/ non traceable cost-** not easily and definitely identifiable (electricity power).
- **Incremental cost -** additional cost as a result of business decisions.
  related to the concept of marginal cost.
- **Sunk cost-** already incurred for ones cannot be recovered (advertising, Railway lines).
- **Historical cost-** cost incurred in past for acquisition of assets like machinery
- **Replacement cost-** money expenditure incurred for replacing an old asset.
- **Private cost-** cost actually incurred by a firm; explicit or implicit.
- **Social cost-** total cost Borne by society (in terms of disutility like pollution).
- **Fixed cost-** this cost does not change with output (rent, property tax, etc.)
- **Variable cost-** function of output in action period change with production (wages, cost of raw material).
- **Shut down cost-** continue even after operations are suspended (storing an old machine which can't be sold).
- **Semi variable cost**- neither perfectly variable nor absolutely fixed (electricity charge both fixed and consumption based)
- **Stair step variable cost-** increase in stair step fashion remains fixed over a certain stage but suddenly jumps to a new higher level. (Salary of foreman)
- **Total cost-** actual cost incurred.
- **Average cost-** cost per unit of output.
  - **TC = TFC+TVC.**
    - TFC= TC- TVC.
    - TVC= TC- TFC.
    - AVC= TVC/Q.
    - AFC= TFC/ Q.
  - **ATC= AFC +AVC**
    - AFC=ATC- AVC
    - AVC=ATC - AFC.
- **Marginal cost-** addition made to total cost by production of additional units of output.
  - **MC=TC/Q**
  - **MCn=Tn - Tn-1**

◆Fixed costs do not change with output.

◆ Average cost comes down with every increase in output

◆ Variable cost increase but not necessary in the same Proportion as increase in output.

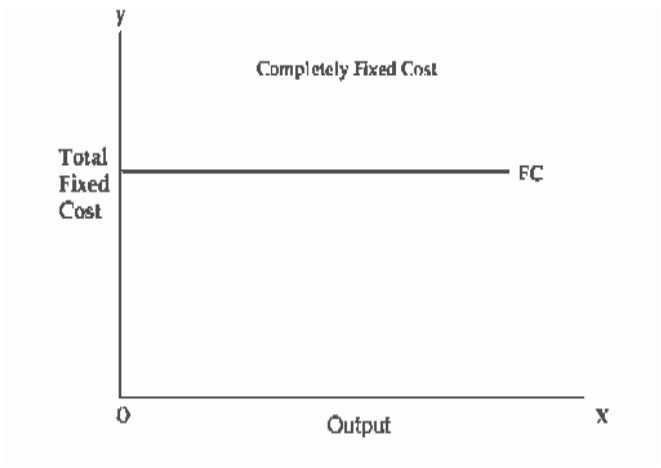
◆When AC falls, MC < AC.

THE SHOW MUST GO ON!!

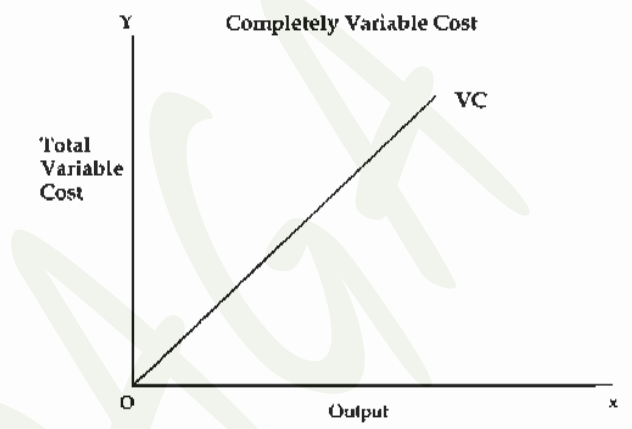
CHAPTER 3: THEORY OF PRODUCTION AND COST

- When AC Rises, MC > AC.
- when AC is minimum MC = AC.

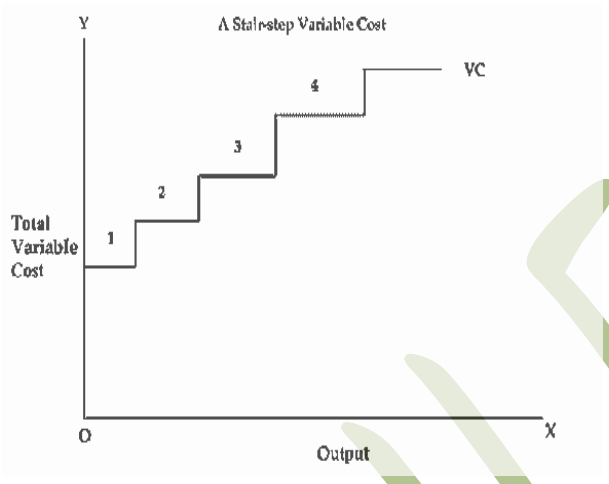
- **Horizontal Straight line parallel to x axis.**



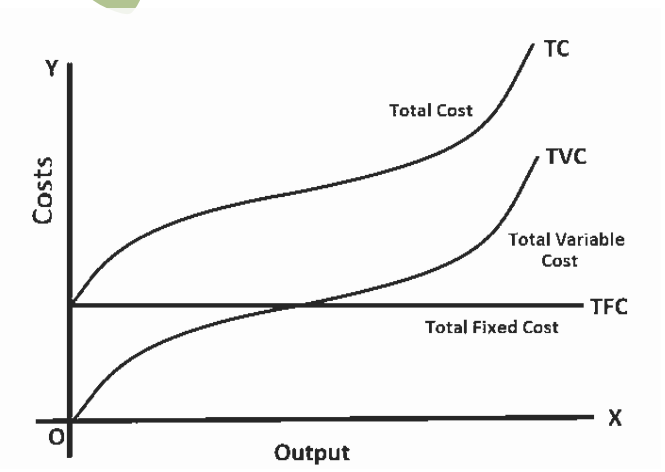
Inverted shaped



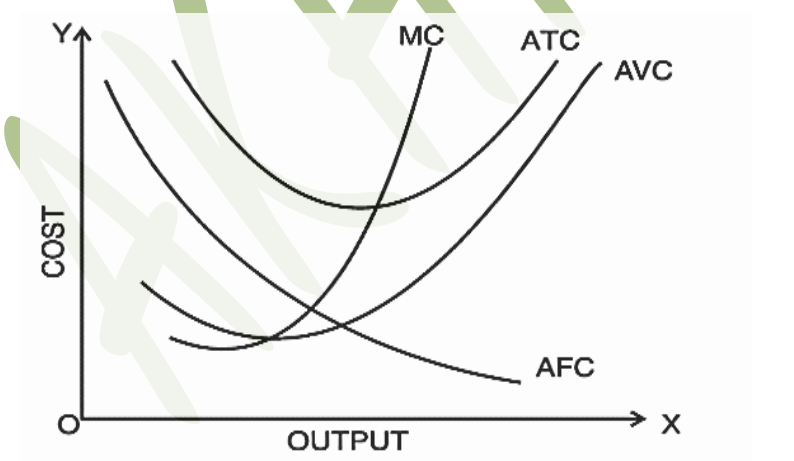
Stair step variable cost.



Short run Total cost curve.



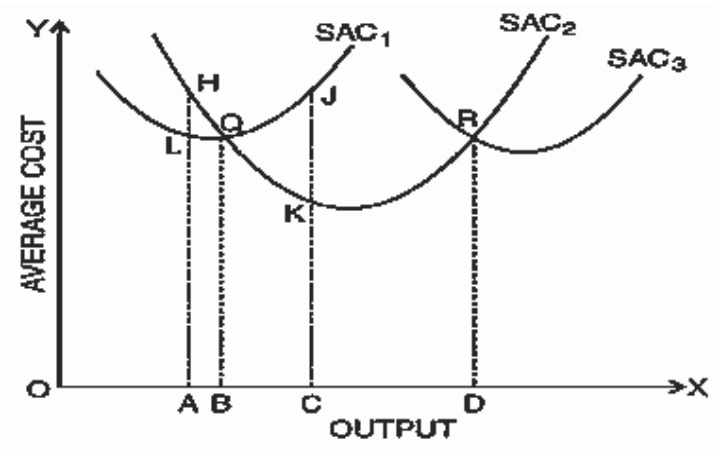
Short run average cost



When AC is minimum, MC= AC

when AC Rises, MC > AC.

when AC Falls, MC < AC.



Envelope curve/ Planning curve

THE SHOW MUST GO ON!!

CHAPTER 3: THEORY OF PRODUCTION AND COST

According to modern theory: LAC is L – Shaped.