

CHAPTER 3

THEORY OF PRODUCTION AND COST

1.

- ❖ Production is one of the important economic activity that takes place in any economy apart from consumption and investments.
- ❖ An individual firm is the micro-economic unit which undertake the production of goods and services.
- ❖ A firm's survival depends upon whether it is able to achieve optimum efficiency in production by minimizing the cost of production.
- ❖ Production is the transformation of resources into goods and services. In other words, production is the act of transformation of INPUTS into OUTPUT which satisfies the wants of some people.
E.g.-Inputs of sugarcane, capital and labour are used to produce SUGAR.
Production also includes production of SERVICES like those of lawyers, teachers, doctors, etc.
- ❖ Man cannot create or destroy matter.
- ❖ Thus, production means creation of those goods and services which have economic utilities i.e., exchange value.
- ❖ Professor J. R. Hicks has defined production "as any activity whether physical or mental, which is directed to the satisfaction of other people's wants through exchange."

2. UTILITIES may be created or added in many ways, such as:-

a) **Form Utility**

- ❖ It is created by changing the form of raw materials into finished goods for man's use.

- ❖ E.g. converting raw cotton into cotton fabric.

- ❖ Form utility is created by manufacturing industries.

b) Place Utility

- ❖ It is created by transporting goods from one place to another.

- ❖ E.g. when goods are taken from factory to marketplace, place utility is created.

- ❖ Transport services are involved in creation of place utility.

c) Time Utility

- ❖ It is created by making things available when they are required.

- ❖ E.g. Banks create time utility by granting overdraft facilities.

d) Service Utility (Personal Utility)

- ❖ It is created by providing personal services to the customers by professionals like lawyers, doctors, bankers, shopkeepers, teachers, transporters, etc.

3. FACTORS OF PRODUCTION

Land:

- ❖ Generally, land means earth's surface.

- ❖ However, in economics land refers to all the free gifts of nature i.e. natural resources. Land includes natural resources:

1. on the surface of earth; E.g. Soil, forest, plots of land, etc.;

2. Below the surface of earth, E.g. mineral deposits, etc., and

3. Above the surface of earth, E.g. climate, sunshine, rain, etc.

❖ Land has the following characteristics:-

1. **Primary Factor.** Land is the original and primary or natural factor of production. It provides various natural resources for production.
2. **Free Gift of Nature.** Land is the creation of nature and not man made. It is a free gift of nature to mankind.
3. **Inelastic Supply.** Land is fixed in supply. Its supply cannot be either increased or decreased by any human efforts. However, its supply is perfectly inelastic from the point of view of an economy.
4. **Lacks Geographical Mobility.** Land cannot be moved bodily from one place to another. However, land is said to be mobile in the sense it can be put to many alternative uses.
5. **Passive Factor.** Land does not yield any result unless human efforts and capital are employed.
6. **Heterogeneous.** Land differs in nature, fertility, uses and productivity from one place to another.
7. **Permanent.** It means that land cannot be destroyed. The productive power of soil is original and indestructible according to RICARDO.
8. **Diminishing Returns.** The land is subject to the Law of Diminishing Returns more quickly in the cultivation of land.

Labour:

- ❖ Labour in economics means any work whether physical or mental done in exchange for some monetary reward.
- ❖ Anything done out of love and affection is not labour in economic sense.

❖ Labour has the following peculiarities (characteristics) which makes it different from other factors:

1. Labour is inseparable from labourer.

❖ All other suppliers of factors can be separated from the factors which they supply. E.g. Land can be separated from its owner.

❖ However, the labourer cannot be separated from the work which he performs. E.g. A doctor has to attend his patients in person. Labour is connected with HUMAN EFFORTS.

2. Human Factor.

❖ It is a live factor of production. Hence, labour has feelings and temperament.

❖ So it is very much affected by surroundings, working conditions, motivation, leisure, recreation, working hours, etc.

3. Highly perishable.

❖ Labour cannot be stored for future use. It is highly perishable.

❖ A day lost without work means a day's work gone forever.

❖ Hence, labourer has weak bargaining power and has to accept even low wages.

4. The labourer sells his services and not himself.

❖ In the labour market it is labour which is brought and sold and not the labourer.

5. Heterogeneous.

❖ Labour power differs from labourer to labourer

❖ Labour power depends upon physical strength, education, skill, training, efficiency, etc.

❖ Hence, labour can be classified as unskilled, semi-skilled and skilled labour.

❖ The skilled labour is called as human capital.

6. Restricted Mobility.

❖ Labour is a mobile factor.

❖ Labour is much less mobile than capital.

❖ Labourer is human being and hence has attachment with his family, custom, religion, culture, etc. and so is hesitant to move from one place to another.

7. Active Factor.

❖ Labour is the most active factor of production. Other factors are made operative with the use of labour.

8. Labour has sociological characteristics.

❖ Employment of labour involves problems relating to labour welfare.

❖ E.g. Social security like provident fund, gratuity, medical benefits, pension, etc.

❖ Other factors do not have such characteristics.

9. Supply curve of labour is backward sloping.

10. The supply of labour is inelastic in short run.

Capital:

❖ In ordinary language, capital is used in the sense of money.

❖ But in economics the term 'Capital' means man made stock of goods like factories, machines, tools, equipments, raw materials, dams, canals, transport vehicles, etc. which are used in production.

❖ Thus, 'Capital' in economics is used in the sense of real capital i.e. capital goods.

❖ Capital has therefore, been rightly defined as "produced means of production" and as "man made instrument of production".

❖ Land and labour are primary or original factors of production. But capital is produced by man working with nature to help in the production of further goods. Following are the main characteristics of capital:-

1. Capital is man-made.

❖ Capital is not produced by nature. It is artificial as it is produced by man.

2. Capital is productive.

❖ Use of capital increases the overall productivity in a given process. It provides tools and implements to labour for production.

3. Supply of capital is elastic.

❖ The supply of capital can be adjusted to demand.

❖ The stock of capital depends on capital formation.

❖ Thus, by raising the rates of savings and investments the supply of capital can be increased.

4. All capital is wealth.

❖ Capital is that part of wealth which is used in further production of wealth.

❖ Hence, capital has all the characteristics of wealth like utility, scarcity, transferability and price.

5. Capital is a passive factor.

❖ It alone is unable to produce anything. It is ineffective without the use of labour and land.

6. Capital is the most mobile factor.

❖ It has both place as well as occupational mobility.

7. Capital is durable.

❖ Physical capital assets like plant and machinery, factor buildings, etc. last over a long time in the process of production. However, they are subject to

- ❖ **Capital involves social cost.**
- ❖ In the creation of capital, the money to be used for present consumption has to be diverted.
- ❖ Sacrifice of present consumption and enjoyment of the people is treated as a social cost.

4. TYPES OF CAPITAL

- ❖ **Fixed capital.** Those durable physical assets which can be repeatedly used in the process of production for long periods are called fixed capital. E.g. Machinery, Plant, Tools, Factories, Railways, etc.
- ❖ **Circulating or Working Capital.** Working capital refers to those goods which are used up in the single act of production. Such goods are used only ONCE in production. E.g. raw materials, power, fuel, etc. They are single use producer's goods.
- ❖ **Sunk Capital.** Sunk capital is the capital which is used to produce only one single commodity. It can be put to a single specialized use only. E.g. A brick kiln can be used only to bake brick and nothing else. Sunk capital therefore, lacks occupational mobility.
- ❖ **Floating Capital.** Floating capital is that which can be put to several uses. E.g. electricity, money leather, etc.
- ❖ **Real capital.** Real capital refers to the physical capital goods like machinery, raw material, factory buildings, etc. which help in production.
- ❖ **Human capital.** The human capital is in the form of people who are equipped with education, skills, training, good health, etc. A faster economic growth can be achieved with the accumulation of human capital.
- ❖ **Tangible capital.** Tangible capital is one which can be seen and touched. E.g. machinery tools, etc. in other words, it is real capital.
- ❖ **Intangible capital.** It cannot be seen or touched. It can only be felt. E.g. goodwill, etc.

- ❖ **Money capital.** It is in the form of shares, debenture, bonds, stock certificates, etc. Money is invested in expectations of returns.
- ❖ **Individual capital.** Capital resources having personal or private ownership of an individual or group of individuals is called individual capital. E.g. Tata Enterprises.
- ❖ **Social capital.** The capital which is owned by the society as a whole is called as social capital. E.g. roads, railways, schools, dams, canals, etc.

5. CAPITAL FORMATION

- ❖ Capital formation means a sustained increase in the stock of real capital in a country.
- ❖ It is thus, an addition of capital goods like machines, tools, factories, transport facilities, power, etc. in the country.
- ❖ Such capital goods are used for further production of goods and thus increases the production capacity of the country.
- ❖ Capital formation is also known as investment.
- ❖ Capital formation plays an important role in the development of an economy generally, higher the rate of capital formation, more economically developed an economy would be.
- ❖ There are mainly three stages of capital formation which are as follows:
 - a) Savings.
 - b) Mobilization of savings
 - c) Investments.

6. ENTREPRENEURSHIP

The entrepreneur owns entrepreneurship. He is that man of production who takes decisions and bears risk. He has also been called the organizer, the manager or risk taker.

Functions of an entrepreneur:

- i. **Initiating a business enterprise and coordination:** The first and foremost function of an entrepreneur is to start a business by collecting various factors of production. Entrepreneur pays remuneration for the various factors of production, remuneration for their services. Whatever surplus is left is his factor payment. If there is no surplus left, he gets no factor payment.
 - ii. **Risk bearing and uncertainty:** Many economists have emphasized that true function of enterprise is to bear risk and uncertainty. According to F.H. Knight, certain risks (insurable risks) like risks of fire, thefts, and accidents, etc., do not cause uncertainty, and thus, do not give rise to profits. It is only non-insurable risks (like risks relating to price decision, output decision, and product variation decision, etc.,) that involve uncertainty and give rise to profits.
 - iii. **Innovation:** some economists regard innovation as the true function of the entrepreneur. In broad sense, innovations include introduction of new production methods, utilization of new sources of raw materials, adoption of new forms of organization, introduction of new product, and discovering new markets.
7. **Enterprise's objectives and constraints:** The standard assumption about an enterprise is that its business activity is carried out with the sole objective of earning profits. However, in the real world, enterprises do not make decisions based exclusively on profit maximisation objective alone. The objectives of an enterprise may be broadly categorised under the following heads.
- i. **Organic objectives:** The basic minimum objective of all kinds of enterprise 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.
 - ii. **Social objectives:** Since an enterprise lives in a society, it cannot grow unless it meets the needs of the society, say for example- providing employment for society people.
 - iii. **Human objective:** 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.

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

Enterprise's problems: An enterprise faces a number of problems from its inception, through its lifetime and till its closure, following are a few problems relating to:

i. **Objectives:** The enterprise faces the problem of not only choosing its objectives but also striking a balance among them.

ii. **Location and size of the plant:** An enterprise has to decide whether the plant should be located near the source of raw material or near the market.

iii. **Selecting and organising physical facilities:** Decision on the nature of production process to be employed and the type of equipments to be installed, which further depends upon the design chosen and the required volume of production.

iv. **Finance:** Financial planning involves

- Determination of the amount of funds required,
- Assessment of demand and cost of its products,
- Estimation of profits on investment and its comparison with existing concerns, and
- Determining capital structure and the appropriate time for financing the enterprise, etc.

v. **Organisation structure:** Division of total work of the enterprise into major specialised functions and then constitute proper departments for each of its specialized functions.

vi. **Marketing:** Problem regarding identification of target market and decision for 4 P's.

vii. **Legal formalities:** Legal formalities relating to assessing and paying different types of taxes (corporate tax, excise duty, sales tax, custom duty, etc.), maintenance of records, submission of various types of information to the relevant authorities from to time, adhering to various rules and laws formulated by government, etc.

- viii. **Industrial relations:** 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, etc.

8. MEANING OF PRODUCTION FUNCTION

Production function states the relationship between inputs and outputs, i.e., the amount of output that can be produced with given quantities of inputs under a given state of technical knowledge. Output takes the form of volume of goods or services and inputs are the different factors of production, i.e., land, labour, capital and entrepreneurship. In other words, it is the transformation of inputs into outputs.

The production function may be two types.

- a. **Short period production function:** In the short run, at least one factor remains fixed and others are variable. This is done when the law of variable proportions is derived.
- b. **Long period production function:** In the long run, all factors are varied in the same proportion and it is the matter of law of returns to scale.

Assumptions:

- Particular unit of time
- Technical knowledge remains constant
- Factors are divisible
- Producer is using best technique

9. Cobb-Douglas production function

This concept is given by Paul H. Douglas and C.W. Cobb of the U.S.A., and in this case, output is manufacturing production and inputs are labour and capital.

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

Where 'Q' is output, 'L' the quantity of labour and 'C' the quantity of capital. 'K' and 'a' are positive constants. In this equation, labour contributed 3/4th and capital contributed 1/4th of production. The function is linear and homogeneous. It shows constant returns to scale, so it is called "Linear Homogeneous Production Function".

10. TYPES OF PRODUCTION

- a. **Total production (TP):** TP is the total output resulting from the efforts of all the factors of production combined together at any time.
- b. **Average production (AP):** Average product or average physical product (APP) may be defined as total product per unit employment of the variable input. Thus,

$$AP = \frac{TP}{\text{Units of Variable Input (Labour)}}$$

- c. **Marginal production (MP):** MP is the change in TP due to change in the quantity of variable factor, i.e., labour. In other words, it is the additional TP due to an additional unit of input.

$$MP = \frac{\text{Change TP}}{\text{Change in Labours}}$$

or say

$$AP = \frac{TP}{\text{Labour}}$$

or

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

For e.g., TP is 200 units when labour is 10, and TP is 250 when labour is 15, MP will be calculated as follow,

$$MP = \frac{TP}{\text{Labour}} = \frac{200 \lambda 250}{15 \lambda 10} = \frac{50}{5} = 10 \text{ units}$$

- d. **Relationship between AP and MP**
- Both AP and MP can be calculated by TP.
 - When AP rises, the MP also rises but $MP > AP$
 - When AP is maximum, the $MP = AP$ 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 opposite never happened.

11. LAW OF VARIABLE PROPORTION (LAW OF DIMINISHING RETURNS)

According to law of variable proportions, as more and more units of a variable factors are combined with same quantity of fixed factors, total product first increases at an increasing rate, then at diminishing rate and finally starts diminishing. It implies that marginal product first rises and then diminishes eventually. Law of variable proportions is also known as law of returns to a factor. It is short-run concept.

Assumptions:

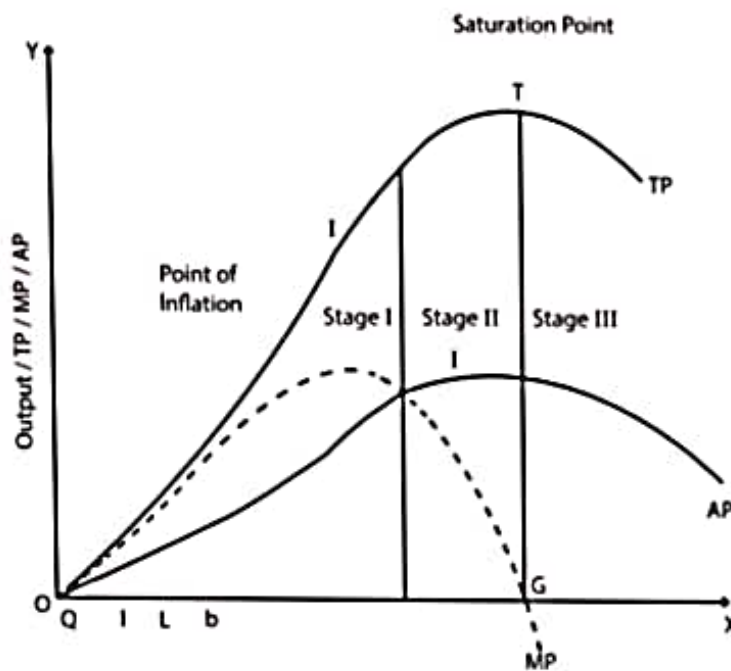
- The technology remains unchanged.
- There must be some inputs whose quantity is kept fixed.
- Law does not apply where factors are used in fixed proportions.
- Only physical input and output are considered.
- All the units of variable factors are homogeneous.
- Law of variable proportion has three stages.

Labour	TP	AP	MP	Analysis for law of variable proportion
1	2	2	2	Stage-I - Law of increasing returns
2	5	2.5	3	
3	9	3	4	
4	12	3	3	State-II - Law of decreasing returns
5	14	2.8	2	
6	15	2.5	1	
7	15	2.1	0	MP = 0, TP is maximum
8	14	1.7	-1	Stage-III - Law of negative returns
9	12	1.3	-2	

Stage	TP	AP	MP
Stage I	Increases at an increasing rate	Increases and reaches at maximum point	Increases and reaches its maximum point
Stage II	Increases at diminishing rate and reaches its maximum point	After reaching its maximum point, begins to decrease	Decreases and becomes zero
Stage III	Begins to fall	Continues to diminish	Becomes negative

1) Explanation of increasing returns (Stage I):

Indivisibility of fixed-factors: 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.



Division of labour and specialization: The second reason why we get increasing returns in the initial stages is that with sufficient quantity of variable factor, introduction of division of labour and specialization becomes possible, which results in higher productivity.

Note: Point of inflexion is that point on TP at which MP is maximum.

2) Explanation of diminishing returns (Stage II):

Inadequate relative of fixed factors: Once the point is reached at which the amount of variable factor is sufficient to ensure the efficient utilization 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.

Imperfect substitutability: Another reason offered for the operation of the diminishing returns is the imperfect substitutability of factors for one another.

Note: Saturation point is the point at which TP is maximum and MP is zero.

3) Explanation of negative returns (Stage III):

Too excessive quantity of variable 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.

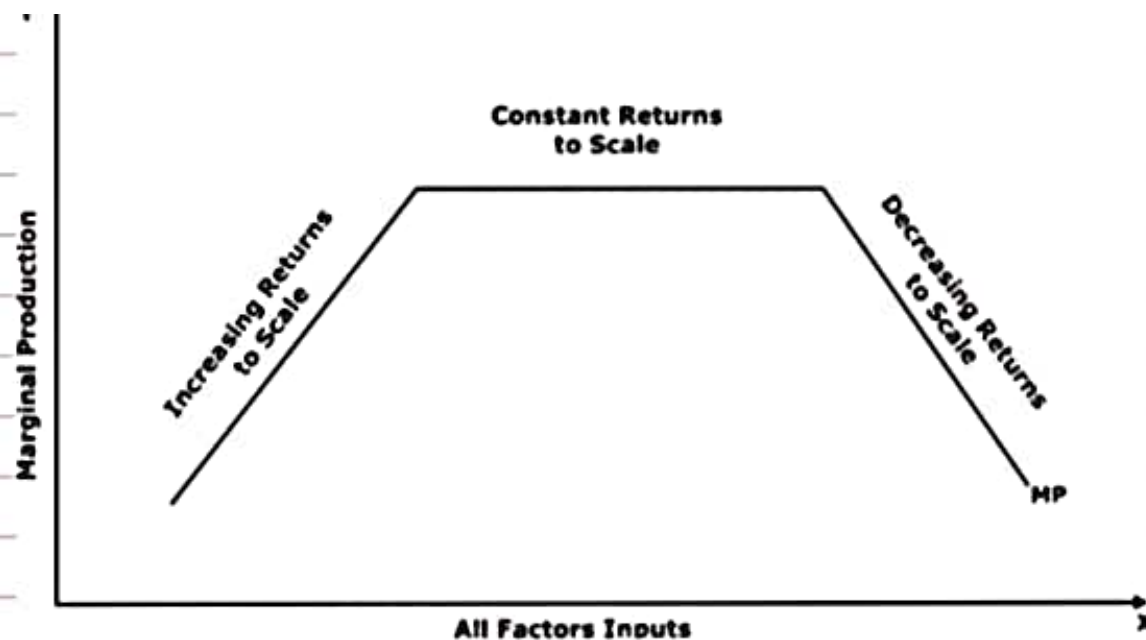
Stage of operation:

The three stages together constitute the law of variable proportions. Since the second stage is the most important, stage II will be stage of operation, and because of that in practice we normally refer to the law of variable proportion as the law of diminishing returns.

12. LAW OF RETURNS TO SCALE

In the long run, all factor inputs in the production function can be changed. The behaviour of output consequent to change in the quantities of all factor inputs in the same proportion (i.e., keeping, the factor proportions unaltered) is known as 'returns to scale'. Return to scale may be three types.

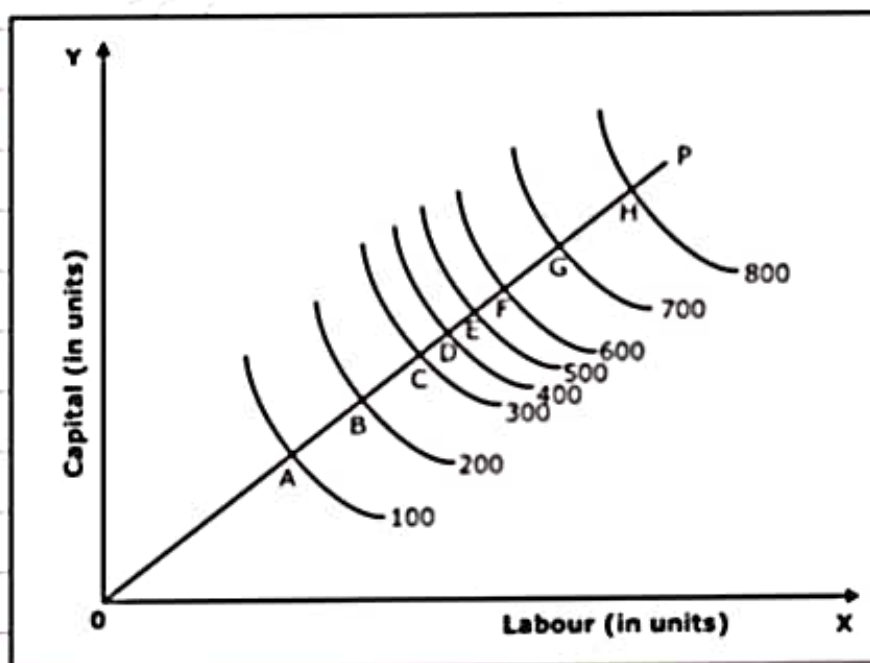
1. **Increasing returns to scale:** Increasing returns to scale occur when a simultaneous increase in all the inputs in the same given proportion result in a more than proportionate increase in the output. For example, if input is increased by 100%, then the output increases by 125%.
2. **Constant returns to scale:** Returns to scale are said to be constant when a proportionate increase in all the inputs results in proportionate increase in output. For example, if input is increased by 100% then the output also increases by 100%. Constant return to scale is also called 'Linear Homogeneous Production Function'.
3. **Diminishing returns to scale:** Diminishing returns to scale occur when simultaneous increase in all inputs in the same given proportion result in a less than proportionate increase in the output. For example, if input is increased by 100%, but the output increases only by 75%.



All the three phase can be shown by one diagram as given above.

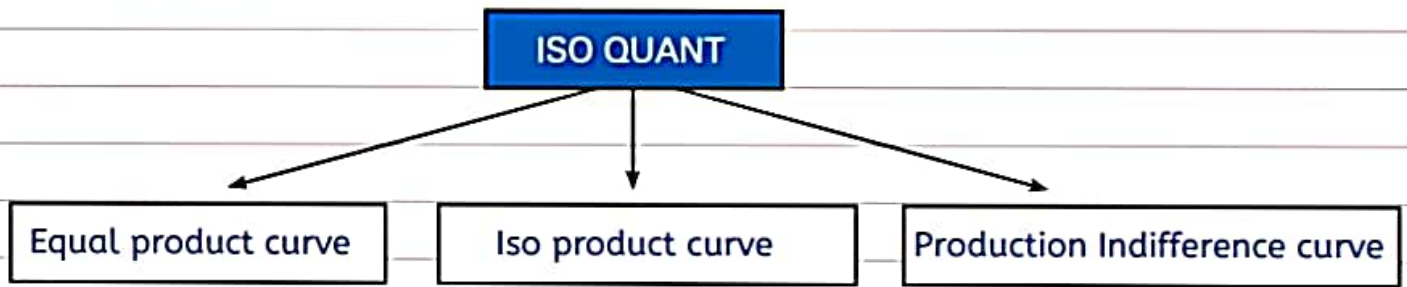
In the above figure from A to B, there is increasing return to scale because MP is increasing, and from B to C, there is constant return to scale because MP is constant, and from C to D there is decreasing returns to scale because MP is decreasing.

The law of increasing, constant and decreasing returns to scale can be understood with the help of ISO Quant Curve (IQC) in this way



In the above figure, all IQC represents equal production curve, i.e., 100 units, but as more units of labour and capital introduced additional output increases in the same manner but labour and capital firstly introduced in decreasing manner

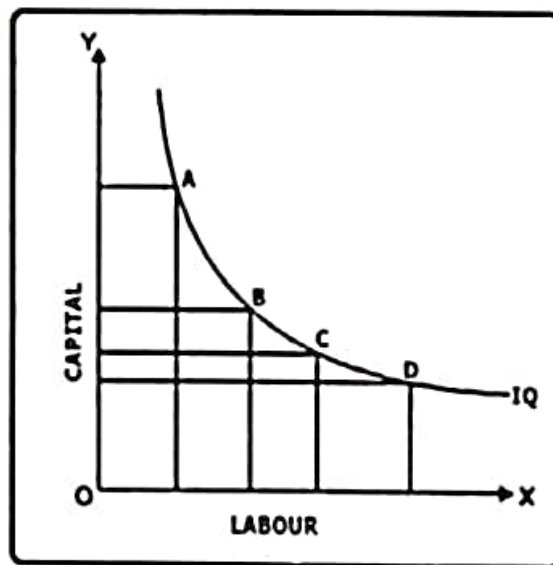
(from A to D) and it gives 'increasing returns to scale', and after that in constant manner (from D to F), it gives 'constant returns to scale', and lastly in increasing manner (from E to H), it gives 'decreasing returns to scale'.



Statements:

Various combinations of two inputs (capital / Labour) that gives same level of output

Combinations	Labour	Capital	DMRTS(Lk)
A	1	12	
B	2	6	6
C	3	4	2
D	4	3	1



'ISO-Cost Line' OR "Equal Cost Lines'

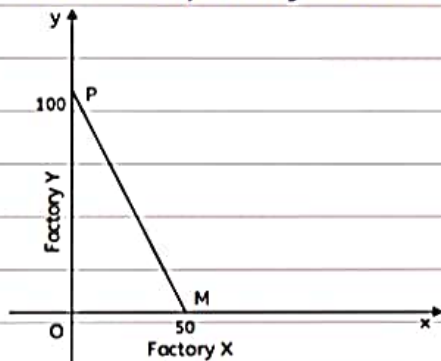
ISO -cost line (also known Equal Cost Line; Price Line; Outlay Line; Factory Line) Shows the various combinations of two factor inputs which the firm can purchase with a given outlay (i.e. budget) and a given prices of two inputs.

Example. A firm has with itself ₹ 1000 which it would like to spend on factor 'X' and factor 'Y'.

Price of factor 'X' is ₹ 20 per unit.

Price of factor 'Y' is ₹ 10 per unit.

Therefore, if the firm spends the whole amount on factor X, it can buy 50 units of X and if the whole amount is spent on factor Y, it can buy 100 units of Y. However, in between these two extreme limits, it can have many combinations of X and Y for the outlay of ₹ 1000. Graphically it can be shown as follows -



In the diagram Op shows 100 units of Y and OM shows 50 units of X. When we join the two points P and M, we get the iso-cost line. All the combinations of factor X and factor Y lying on iso-cost line can be purchased by the firm with an outlay of Rs 1000. If the firm increases the outlay to Rs 2000, the iso-cost line shifts to the right, if prices of two factors remains unchanged. The slope of the iso-cost line is equal to the ratio of the prices of two factors. Thus,

$$\text{Slope of line PM} = \frac{\text{Price of X}}{\text{Price of Y}}$$

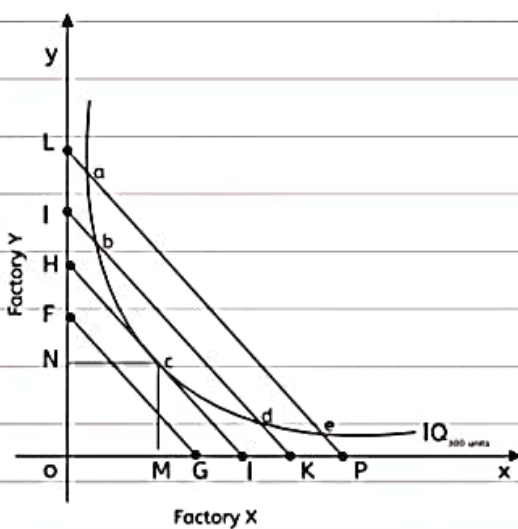
Producer's Equilibrium OR Production Optimization

A firm always try to produce a given level of output at minimum cost. For this it has to use that combination of inputs which minimizes the cost of production. This ensures maximization of profits and produce a given level of output with 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 same level of out. The isoquants are negatively sloped and convex to origin. The slope of isoquants shows the marginal rate of technical substitution which diminishes. Thus, $MRTS_{xu}$

$$= \text{Slope} = \frac{\Delta y = MP_x}{\Delta x \quad MP_y}$$

Iso-cost line shows the various combination of two factor inputs which the firm can purchase with a given outlay and at given prices of inputs. There can be different outlays and hence different iso-cost lines. Slope of iso-cost line shows the ratio of the price of two inputs i.e. $\frac{P_x}{P_y}$



Which will be the least cost combination can be understood with the help of following figure. Suppose firm wants to produce 300 units of a commodity. It will first see the isoquant that represents 300 units.

In the adjoining diagram we find that all combination a, b, c, d and e can be produce 300 units of output. In order to produce 300 units firm with try to find out least cost combination. For this it will super impose the various iso-cost lines on isoquant as shown in the diagram. The diagram shows that combination 'C' is the least cost combination as here isoquant is tangent to iso-cost line HI. All other combinations a, b, d and e lying on isoquant cost more as these points lie on higher iso-cost lines. Hence, the point of tangency of isoquant and iso-cost line shows least cost combination. At the point of tangency.