Quick View

Production – Meaning

Processes and methods employed in transformation of tangible inputs (raw materials, semi-finished goods, or subassemblies) and intangible inputs (ideas, information, know how) into goods or services.

The concept of a Production Function

The **production function** is a mathematical expression which relates the quantity of factor inputs to the quantity of outputs that result. The production function has the general form $Q = f(L, K, \ldots)$ where Q is output, L is labor input, K is capital input and where other inputs may also be used.

In economic theory there are two types of factor inputs:-

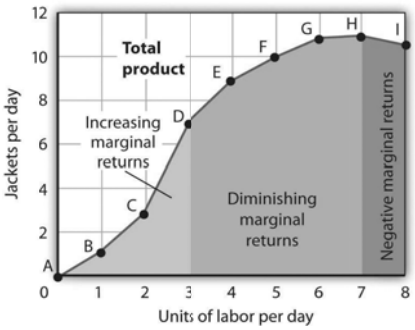
FIXED INPUTS: Fixed inputs are those factors the quantity of which remains constant irrespective of the level of output produced by a firm. For example, land, buildings, machines, tools, equipments, superior types of labor, top management etc.

VARIABLE INPUTS: Variable inputs are those factors the quantity of which varies with variations in the levels of output produced by a firm for example, raw materials, power fuel, water, transport and communication

The Short Run Production Function

The **short run** is defined in economics as a period of time where **at least one factor of production is assumed to be in fixed supply i.e. it cannot be changed**. We normally assume that the quantity of capital inputs (e.g. plant and machinery) is fixed and that production can be altered by suppliers through changing the demand for variable inputs such as labour, components, raw materials and energy inputs. Often the amount of land available for production is also fixed.

We make use of three measures of production / productivity.



- **Total product** is simply the total output that is generated from the factors of production employed by a business. In most manufacturing industries such as motor vehicles, freezers and DVD players, it is straightforward to measure the volume of production from labour and capital inputs that are used. But in many service or knowledge-based industries, where much of the output is "intangible" or perhaps weightless we find it harder to measure productivity

The Three Phases and the corresponding shape of TP is:

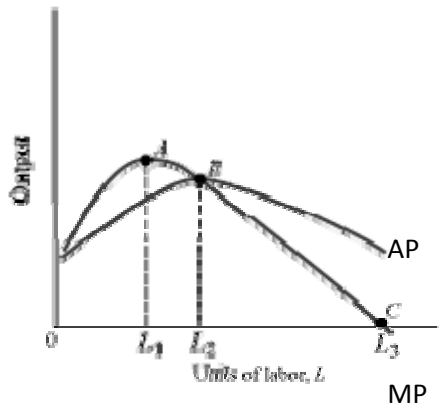
Phases	**Shape of TP**
TP increases at Increasing rate	Covex: upward sloping upto D
TP increases at Decreasing rate	Concave: upward sloping (after D upto H)
TP falls	Downward sloping after H

- **Average product** is the total output divided by the number of units of the variable factor of production employed (e.g. output per worker employed or output per unit of capital employed)
- **Marginal product** is the change in total product when an additional unit of the variable factor of production is employed. For example marginal product would measure the change in output that comes from increasing the employment of labour by one person, or by adding one more machine to the production process in the short run.

Relation between MP and AP

This is a marginal-average relationship. It is as follows:

1) When MP > AP, AP rises
2) When MP = AP, Ap is constant
3) When MP < AP, AP falls



Law of Variable Proportions

This law is one of the most fundamental laws of production. It gives us one of the key insights to the working out of the most ideal combination of factor inputs.

In the short-run the level of production can be changed by changing the factor proportions. This law examines the production function with on factor variable, keeping the other factors quantities fixed. In other words this law explains the short-run production function. When the quantity of one input is varied, keeping other inputs constant, the proportion between factors changes. When the proportion of variable factors increases, the total output does not always increase in the same proportion, but in varying proportion. In other words all factor inputs are not available in plenty. Hence, in order to expand the output, scarce factors must be kept constant and variable factors are increased in greater quantities. Additional units of variable factor on the fixed factors will certainly mean a variation in output. The law of variable proportions or the way of non – proportional output explains how variation in one factor

input give place for variations in outputs. The law can be stated as the following: **As the quantity of different units of only one factor input is increased to a given quantity of fixed factors, beyond a particular point, the marginal, average and total output eventually decline.**

Law of Diminishing Marginal Product

Assumptions of the Law

1. Only one variable factor unit is to be varied while all other factors should be kept constant.
2. Different units of variable factor are homogenous.
3. Techniques of production remain constant.
4. The law will hold good only for a short and a given period.
5. There are possibilities for varying the proportion of factor inputs

Thus, the law states that if more and more units of a variable factor are applied to a given quantity of fixed factor, the total output may initially increase at an increasing rate but beyond a certain level the total output, the rate of increase in total output eventually diminishes in the use of additional units of the variable factor. The volume of goods produced can be looked at form three different angles viz.

STAGE 1: STAGE OF INCREASING RETURNS

The first stage goes from origin to the point where the average output is maximum i.e. P because corresponding to this point P the MP is rising and reaches its highest point. When a firm expands output by increasing the quantity of variable factors in proportion to fixed it moves towards optimum combination of factors of production. After the point P, MP decline and as such TP increases gradually. In this stage the law of increasing return may be said to operate and marginal product begins to fall i.e law of diminishing returns set in. The First stage comes to an end at the point where MP curve cuts the AP curve when the AP is maximum at N.

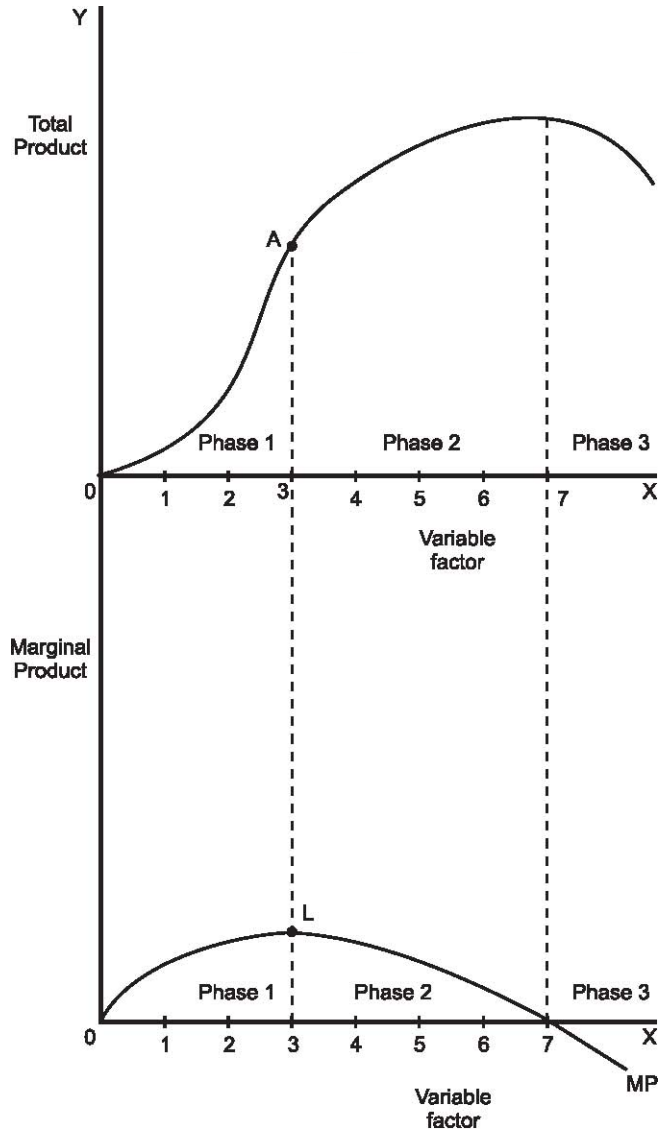
STAGE 2: STAGE OF DIMINISHING RETURNS

The second stage goes from the point where the average output is maximum to the point where the marginal output is zero. After having attained the optimum. Combination of the fixed inputs and the variable input, if the firm increases still further the quantity of the variable input, the per unit output of the variable input falls. In this stage, total output rises but only at a diminishing rate

STAGE 3: STAGE OF NEGATIVE RETURNS

The third stage covers the range over which the marginal output is negative and total output naturally falls. No producer will operate at this stage, even if he can procure the variable input at zero prices. The

first and the third stages are known as stages are known as stages of economic absurdity or economic non-sense. A producer will always seek to operate in the second stage. At which point the producer will operate in this stage will depend upon the prices of the factor inputs. In the following figures we have drawn TP and units of variable upmost in one figure and AP and MP and units of variable inputs in the other figure. In both the table and the graphic representation e see that both average and marginal products first increase reach the maximum and eventually decline



Long run production - returns to scale

In the long run, **all factors of production are variable**. How the output of a business responds to a change in factor inputs is called **returns to scale**.

- **Increasing returns** to scale occur when the % change in output > % change in inputs
- **Decreasing returns** to scale occur when the % change in output < % change in inputs
- **Constant returns** to scale occur when the % change in output = % change in inputs

Cost

Explicit Cost

It is a business expense that is easily identified and accounted for. Examples of explicit costs would be items such as wage expense, rent or lease costs, and the cost of materials that go into the production of goods. With these expenses, it is easy to see the source of the cash outflow and the business activities to which the expense is attributed.

Implicit Cost

A cost that is represented by lost opportunity in the use of a company's own resources, excluding cash. These are intangible costs that are not easily accounted for. For example, the time and effort that an owner puts into the maintenance of the company rather than working on expansion.

Normal Profit

Normal profit is the minimum level of profit needed for a company to remain competitive in the market. It is also known as "economic profit".

The sum of explicit cost, implicit cost and normal profits is called economic cost.

Components of Economic Costs

- Total cost (TC): Total Cost equal fixed cost plus variable costs. TC = FC + VC.
  - Variable cost (VC): Variable costs are the costs paid to the variable input. Inputs include labor, capital, materials, power and land and buildings. Variable inputs are inputs whose use varies with output. Conventionally the variable input is assumed to be labor.
    - Total variable cost (TVC) or (VC) total variable costs is the same as variable costs.
  - Fixed cost (FC) fixed costs are the costs of the fixed assets those that do not vary with production.
    - Total fixed cost (TFC) or (FC)

- Average cost (AC): average cost is total costs divided by output. AC = FC/q + VC/q
  - Average fixed cost (AFC) = fixed costs divided by output. AFC = FC/q. The average fixed cost function continuously declines as production increases.
  - Average variable cost (AVC) = variable costs divided by output. AVC = VC/q. The average variable cost curve is typically U-shaped. It lies below the average cost curve and generally has the same shape - the vertical distance between the average cost curve and average variable cost curve equals average fixed costs. The curve normally starts to the right of the y axis.
  - Marginal cost (MC): Marginal cost is the change in total costs from increasing output by one extra unit**.**

Short Run Costs

In the **short run,** because **at least one factor of production is fixed**, output can be increased only by adding more **variable factors.** Hence we consider both **fixed and variable costs**

RELATIONSHIP BETWEEN MARGINAL COST (MC) AND AVERAGE COST (AC)

The relationship between marginal cost and average cost is an arithmetic relationship. To understand this relationship let us take a numerical example.

The table A shows the marginal costs, total costs and average costs at different levels of output.

Table A

Output (Units)	**Total cost (Rs.)**	**Marginal cost (Rs.)**	**Average cost (Rs.)**
(1)	(2)	(3)	(4)
1	60	60	60
2	110	50	55
3	162	52	54
4	216	54	54
5	275	59	55

Column 1 shows the level of output.

Column 2 shows the total cost of producing different levels of output.

Column 3 shows the increase in total cost resulting from the production of one more unit of output.

(It is called marginal cost. Thus MCn = TCn - TCn-1, where n and n-1 are levels of output).

Column 4 shows the average cost at different levels of output

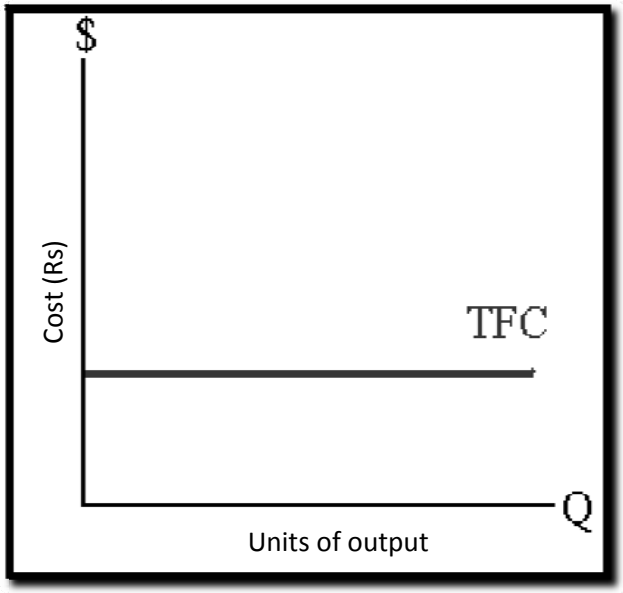
This table shows that :

1. Average cost falls only when marginal cost is less than average cost. Upto the third unit of output, the marginal cost is less than the average cost and average cost is falling. When 2 units are produced the marginal cost is Rs. 50 which is less than the previous average cost (Rs.60), now average cost falls from Rs. 60 to Rs. 55. When 3 units are produced, the marginal cost is Rs. 52 which is less than the average cost of 2 units (Rs. 55) so once again the average cost falls from Rs. 55 to Rs. 54.

2. Average cost will be constant when marginal cost is equal to average cost. When 4 units are produced, average cost does not change (It is Rs. 54 when 3 units are produced and remains Rs. 54 when 4 units are produced) because marginal cost (Rs. 54) is equal to average cost (Rs. 54).

3. Average cost will rise when marginal cost is greater than average cost. When 5 units are produced average cost rises from Rs. 54 to Rs. 55, because the marginal cost (Rs. 59) is greater than the average cost (Rs. 54). This relationship between marginal cost and average cost is a generalized relationship and holds good in case of the marginal and average values of any variable, be it revenue or product etc.

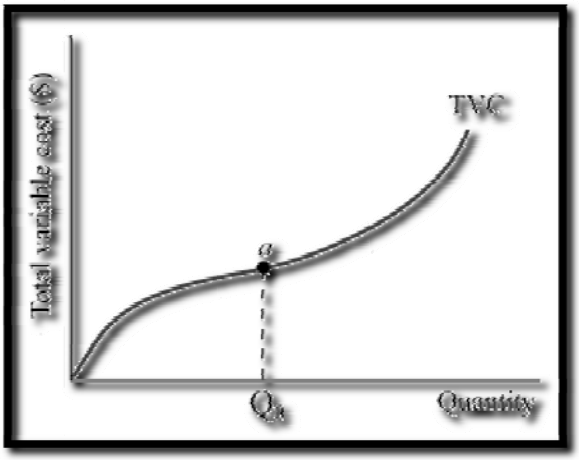
Total Costs



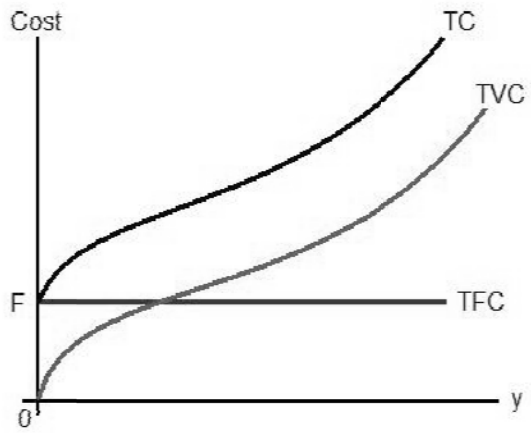
Total Fixed Cost: It remains constant at all levels of output. TFC curve, therefore, is parallel to the x-axis.

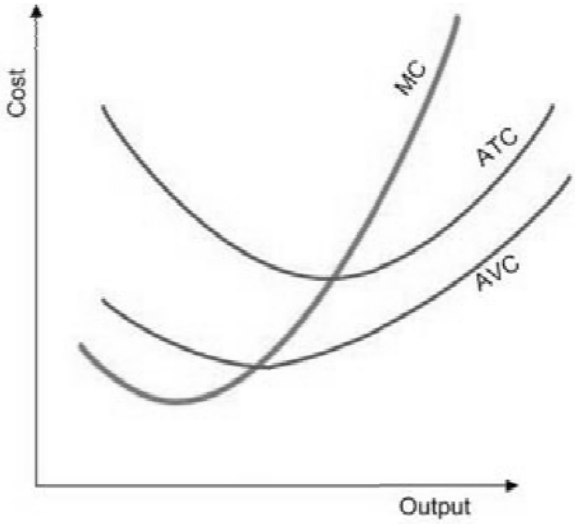
Total Variable Cost: There are two phases in the behavior of TVC as output increases. In the first phase, TVC rises at decreasing rate. It means every new unit of output produced involves lower cost. It is because of increase in the efficiency of the variable input due to proper utilization of fixed inputs, specialization and division of labour.

In the second phase, TVC rises at an increasing rate. This means that every new unit of output produced has a higher cost as compared to the previous unit.



Total Cost: It is the sum of TFC and TVC. Since TFC is constant at all levels of output, TC always exceeds TVC by the amount of TFC.





Mathematical Relation between MC and AC

MC affects AC, whether AVC or ATC.

a) If MC is lower than AC, then AC falls

b) If MC is equal to AC, then AC is constant.

c) If MC is greater than AC, then AC rises.