

Production function

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Production Function

Meaning & concept

Production is the art of transforming inputs into output.

Production function is the functional relationship between physical factor inputs and output of a firm per unit of time under a given state of technology.

$$Q=f(L, C, T, N, \underline{E}\dots\dots n)$$

Meaning & concept

Q= physical quantity of output

f= functional relation

L, C, N, E....= various inputs

T= technology is constant in short run and at times in the long run.

Features of production function

It is a flow concept

Expressed in physical terms

Production for a firm depends on state of technology and inputs

Functional relationship between changes in input and consequent changes in output depends on time element

Short Run Production Function

Short run production function includes **fixed** and **variable** factors

Output can be  or  by changing variable factors only

Assumed that state of technology is constant

$$Q = f (L, \overline{C})$$

The () indicates constant technology

Long Run Production function

All factors are variable

Technology may remain constant

Size of the plant and it's scale can be completely

 or  to adjust to the production

Labour

Capital

variable factors

$$Q = f(L, C)$$

TP, AP and MP

1. **Total Product (TP):** is total amount of a commodity produced during a period of time

$$TP = f (Q)$$

2. **Average Product (AP):** is TP per unit of a given variable factor.

$$AP = TP/Q$$

3. **Marginal Product (MP):** addition made to TP by employing an additional unit of a factor.

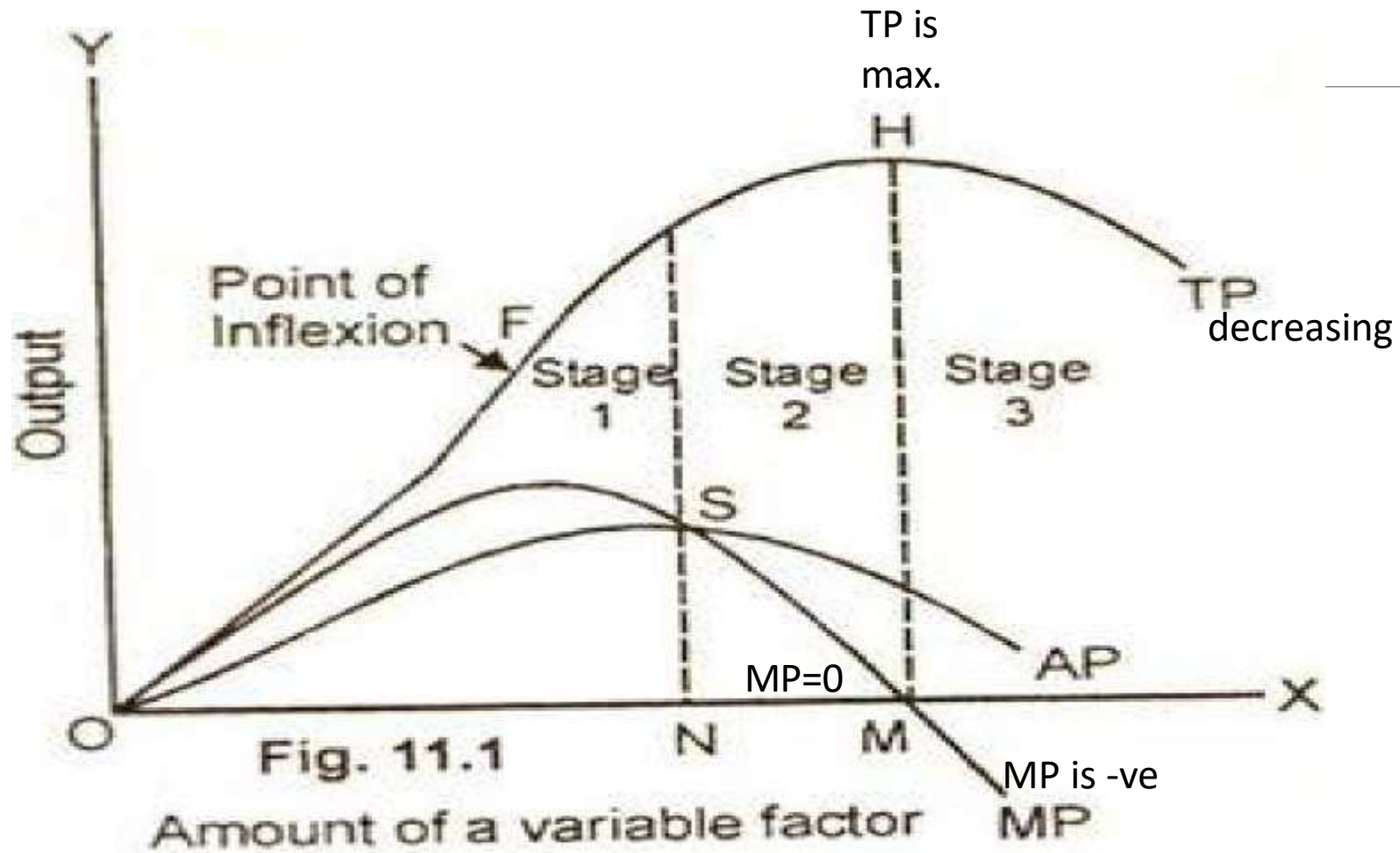
$$MP = \triangle TP / \triangle Q$$

Law of variable proportions

Statement: In the short run, as the **amount of variable factor increases**, other things being equal , the **output** will increase **more than proportionately initially**, then it may increase in the **same proportion** and ultimately it will increase **less than proportionately**.

Units of variable factor (Q)	TP	AP=TP/Q	MP	Stages of production
1	20	20	20	Stage I
2	50	25	30	
3	90	30	40	
4	120	30	30	
5	135	27	15	Stage II
6	144	24	9	
7	147	21	3	
8	148	18.5	1	
9	148	16.4	0	
10	145	14.5	-3	Stage III

Law of Variable Proportions



Stages of Law

This law has THREE stages

1. Increasing Returns
2. Diminishing Returns
3. Negative Returns

Increasing Returns

In this stage, AP increases, MP increases and also TP.

TP increases at more proportionate rate .

TP increases from 20 to 145 units.

This stage is known as increasing returns. This stage of increasing output by increasing labour does not last for a long time. This continues upto 4th units.

Point F onwards TP increases at a diminishing rate. In the first stage, marginal product curve of a variable factor rises in a part and then falls.

The average product curve rises throughout and remains below the MP curve. MP reaches maximum in this stage

Diminishing Returns:

This is the most important stage in the production function

the total production continues to increase at a diminishing rate until it reaches its maximum point where the 2nd stage ends

both the MP and AP of the variable factor are diminishing but are positive. When TP reaches the maximum, MP is zero. MP intersects the X axis

As more and more variable factors are used on fixed factor, MP and AP begins to decrease

Factors of production are indivisible

Economically this is the most viable area of production

Negative Returns.

In the IIIrd stage, the TP decreases. The TP, curve slopes downward (From point H onward).

The MP curve falls to zero at point L^2 and then turns negative. When we increase labour even after MP reaches zero, then MP becomes negative and it goes below the X axis.

This is the most unviable region. In our table from 9th unit onwards, this stage starts.

Any sensible producer will stop the production in the IInd stage where AP and MP begins to decrease, but MP has not turned negative.

producer will employ the variable factor (say labor) up to the point where MP of $L = W$ of L

Causes of Increasing Returns

Indivisibility of fixed factors: employment of variable factors on fixed factors results in better utilisation of the fixed factor causing increasing returns.

Specialisation & economies of scale: advantages of division of lab. results in more efficient use of fixed factors.

Causes of Diminishing returns

The proportion between the fixed and variable factors reaches an optimum point

Beyond the optimum point emp. of additional factors will lead to diminishing returns

It is b'se decline of efficiency of variable factors due to relative shortage of fixed factors.

Fixed factors cannot be increased

Variable factor cannot substitute fixed factors.

Causes of negative returns

efficiency of fixed factors is reduced when excessive amt. of variable factors is used with fixed factor.

Stage III of negative returns is irrational