

Chapter -6

Law of returns & returns to Scale

In this chapter, we will discuss the relationship between input & output. It is because when ever a firm has to increase the output, it has to increase the input. But rate of output is not the same this is explain by theory of production. But before to understand these theories we have to understand important terms.

- 1) Production:- It is that activity in which input is converted into output.
- 2) Factors of production:- these are those factors which help in production process. These factors can be divided into two parts:-
 - a) Fixed factors:- these are those factors which cannot be changed by firm in short period such as land, build, P&M, equipment transport equipments etc.
 - b) Variable factor:- These are those factors which can be changed by a firm in short period according to requirement. For eg:- labor, electricity fuel, power etc.

Production, functions:- It expresses functional relationship between input & output.

$$Q_x = f(F_1, F_2, F_3, \dots, F_n)$$

Short-run & long- run :-

Short run is that period of time in which a firm can change only supply of variable input. Fixed factors cannot be changed.

Long run :- It is that period of time in which a firm can change supply of all inputs. Hence, there is no diff-between fixed & variable factors.

Concepts of Production:-

Total physical production (TPP):- This is the total output which a firm produce with the help of given input.

Average Physical Production(APP) :- This is per unit production of a particular factor.

$$APP = \frac{TPP}{\text{Units}}$$

Marginal Physical Production (MPP) :- this is the incremental change in TPP due to change in no of units.

$$MPP = \frac{\Delta TPP}{\Delta Q}$$

Relationship between TPP, APP & MPP

Units of labor	TPP	APP	MPP
1	20	20	20
2	50	25	30
3	90	30	40
4	120	30	30
5	140	28	20
6	150	25	10
7	150	21.4	0
8	140	17.5	-10
9	120	13.3	-20

Practice

Units of labor	TPP	APP	MPP
1	10	10	10
2	18	9	8
3	26	8.6	8
4	26	6.5	0
5	30	6	4

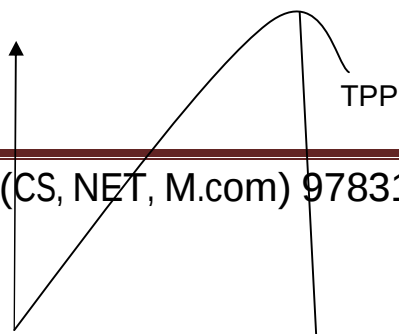
$$APP = \frac{TPP}{Q}$$

$$TPP = APP \times Q$$

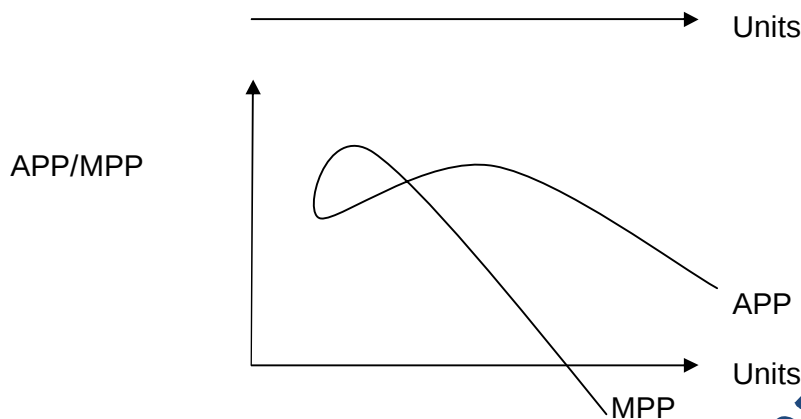
$$MPP = \frac{\Delta TPP}{\Delta Q}$$

$$TPP = \sum MPP$$

Units of labor	TPP	APP	MPP
1	5	5	5
2	9	4.5	4
3	12	4	3
4	14	3.5	2
5	15	3	1



TPP



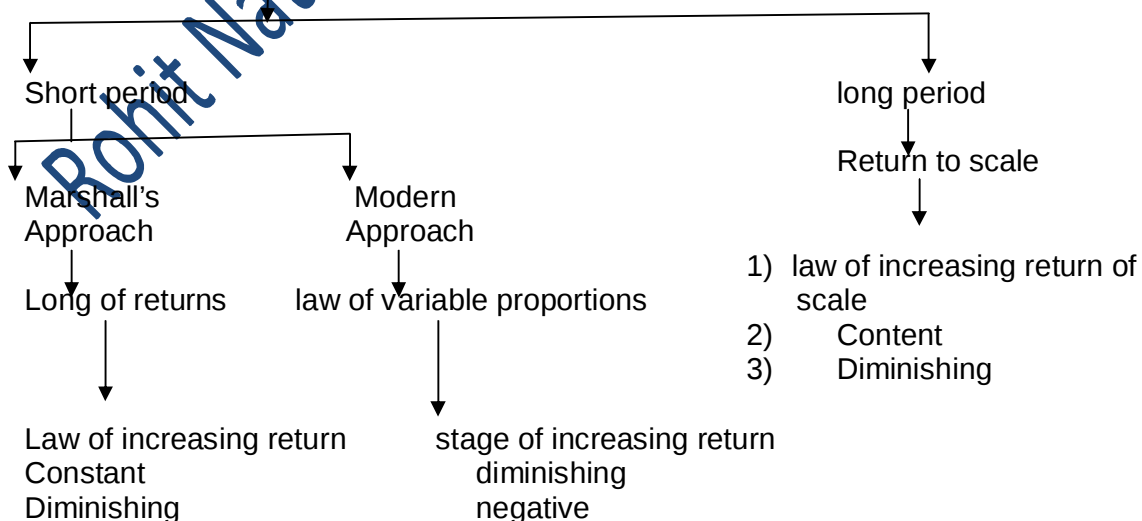
Between TPP & MPP:-

- 1) When TPP increase at increasing rate, then MPP also increases.
- 2) When TPP increases at diminishing rate then MPP falls.
- 3) When TPP at max. Point, then MPP is zero.
- 4) When TPP starts falling then MPP becomes negative.

Between APP & MPP :-

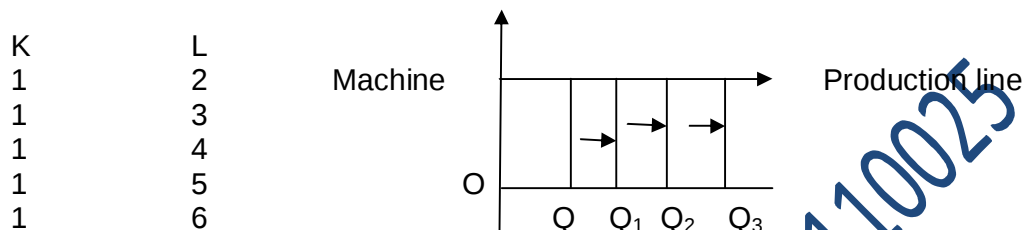
- 1) APP & MPP both are derives from TPP, but MPP rise faster & falls faster than APP.
- 2) When MPP is greater than APP, then APP also rises.
- 3) When MPP is less than APP, then APP falls
- 4) When MPP intersects to APP, then APP is at max.

Input –output relationship

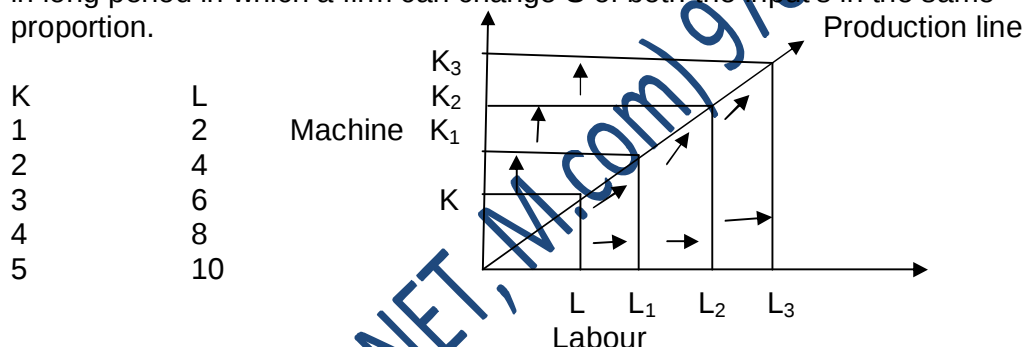


Types of Production Functions:-

- 1) Variable production function:- This type of production function is applicable in short-period in which when a firm can change only S of variable input by keeping S of fixed factor constant, then factor proportion is variable.



Constant Production Function :- This type of production function is applicable in long period in which a firm can change S of both the input's in the same proportion.



Law of returns :- It is a short period law in which when a firm increases S of a variable input, then initially output increases at increasing rate, then at constant rate & finally at diminishing rate.

"It expresses relationship between change in a variable input (labor) to result in output.

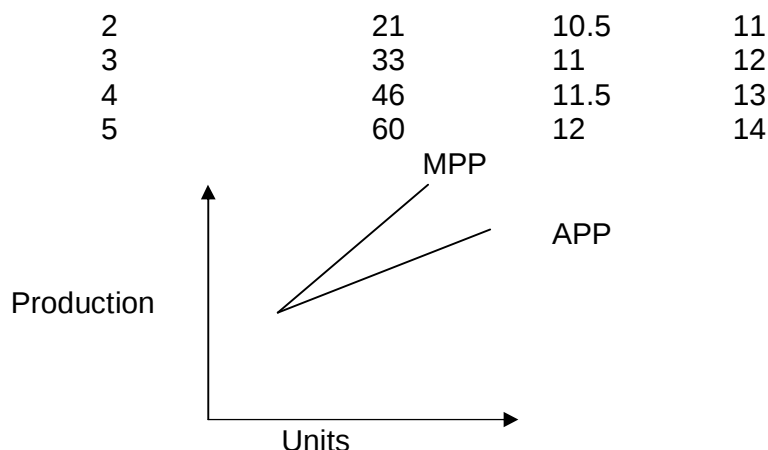
Assumption:

- It is a short period law, hence only one factor is variable i.e. labour.
- Technique of production is constant.
- Units of factor is homogeneous.
- Factors proportion can be change.

Types:-

- 1) Law of increasing returns:- "When proportionate increase in output is greater than proportionate increases in input, then this is called increase in returns." It can be explained with the help of schedule & diagram.

Units of labour	TPP	APP	MPP
1	10	10	10



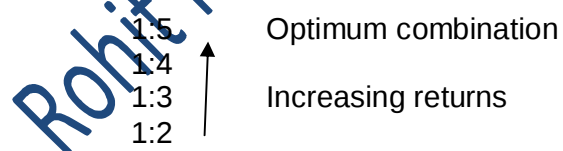
Law of increasing returns in terms of diminishing cost-intially when a firm gets increasing returns, then per unit cost of production to the firm keeps on diminishing. Therefore, this is also called law of diminishing cost.

$$\text{Cost} = \frac{\text{Price of labour}}{\text{MPP of labour}}$$

Units of labour	TPP	APP	MPP	Cost
1	10	10	10	10
2	21	10.5	11	9.1
3	33	11	12	8.3
4	46	11.5	13	7.6
5	60	12	14	7.1

Causes of the application of increasing returns:-

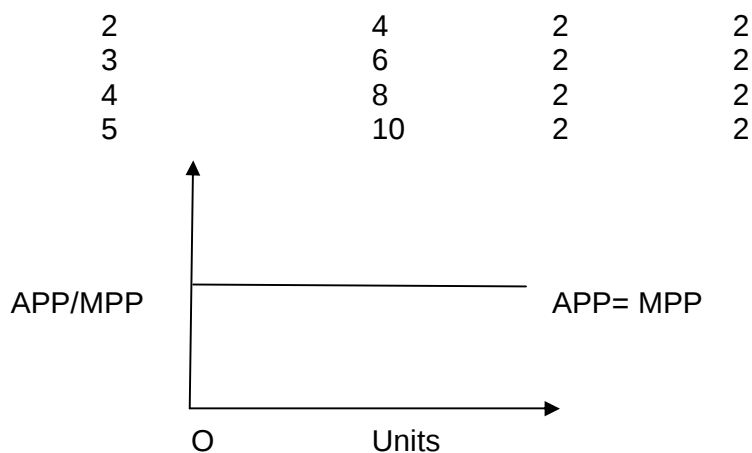
- Indivisibility of cap:- when fixed cap cannot be divided in parts & initially it is be used for less production, then it is under utilized when we increase the variable input on this then it is properly utilized. Hence it causes increasing returns for eg:- if a transport company is using a trunk for loading purposes having more capacity.
- Optimum combination :- This is the best combination of fixed & variable factors, when a firm starts the production below this point then upto this point returns keeps increasing.



- Specialization :- when a firm increase S of a variable input, then it increases possibility of specialization, which will cause increasing returns.

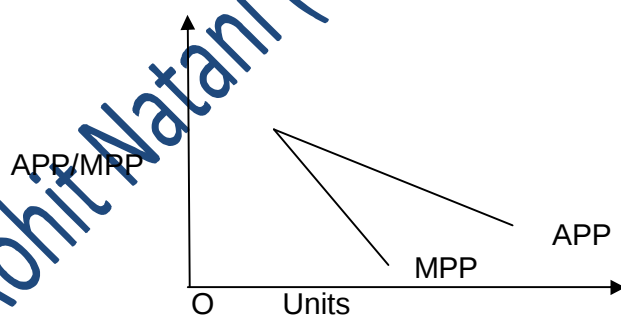
- Law of constant returns:- When proportionate increase in output is equal to proportionate increase in input then this is called law of constant returns.

Units of labour	TPP	APP	MPP
1	2	2	2



- 3) Law of diminishing returns:-When % increase in output is less than % increase input, then this is called law of diminishing returns. According to a classical economists this stage enters only in agricultural sector, whereas according to modern economists, after the fuller utilization of resources diminishing returns can not be avoided & it enters in all productive activities. It can be discuss with the help of schedule & diagram.

Units of labour	TPP	APP	MPP
1	10	10	10
2	19	9.5	9
3	27	9	8
4	34	8.5	7
5	40	8	6



Diminishing returns in terms of increasing costs when a firm gets diminishing returns, then per units cost of production to the firms keeps increasing.

Units of labour	TPP	APP	MPP	Cost
1	10	10	10	10
2	19	9.5	9	11.01
3	27	9	8	12.5
4	34	8.5	7	14.2
5	40	8	6	16.6

Causes for the application of Diminishing returns

- 1) Imperfect substitution:- In short period, when a firm increase S of a variable input to increase in a output even after the limit, then this factor substitution will not be perfect & causes diminishing returns.
- 2) Optimum combination:- when a firm increases S of a variable input even after best combination then combination of a factors becomes defective & causes diminishing returns.
 1:8
 1:7
 1:6
 1:5 → optimum combination.
 Diminishing returns
- 3) Excess use of fixed cap:- when a firm increases S of a variable input, even after the capacity of fixed cap., then the fixed factor is over-utilized & causes diminishing returns.

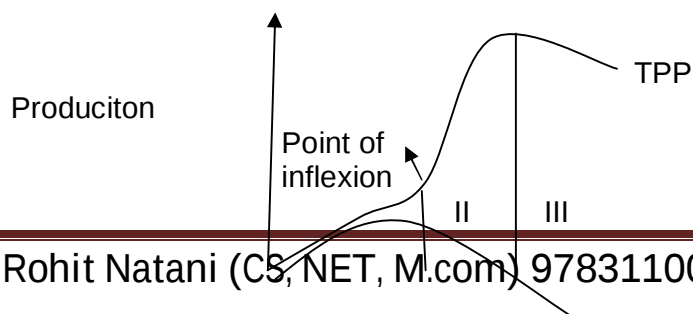
Law of variable proportions:- It is a short period law in which when a firm increases S of variable input, then initially output increases at increasing rate, then at diminishing rate & finally at negative rate.

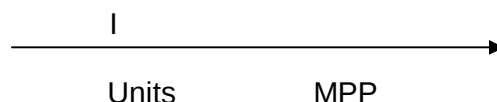
Assumption

- 1) It is a short period law, hence only one factor is variable i.e. labour.
- 2) Technique of production is constant.
- 3) Units of factors is homogeneous.
- 4) Factors proportion can be changed.

Explanation of Law:- It can be explained with the help of production schedule & curve.

Units of labour	TPP	MPP	
1	10	10	1 stage [stage of increasing returns]
2	25	15	
3	45	20	
4	70	25	
5	90	20	2 nd stage stage of diminishing return
6	100	10	
7	105	5	
8	105	0	3 rd stage stage of negative returns
9	100	-5	
10	90	-10	





- 1) 1st stage:- This stage is called stage of increasing returns, in which TPP rises at increasing rate, till the point of inflexion. MPP in this stage rises and stage is determined where MPP is max.
- 2) 2nd stage:- This stage is called stage of diminishing returns, in which TPP rises at diminishing rate & stage is determined when TPP is max MPP in this stage continues to fall & stage is determined, when MPP is zero. This is the best stage from the producer point of view because in this stage a producers extent.
- 3) 3rd stage:- This stage is called stage of negative returns, in which TPP starts & MPP become negative

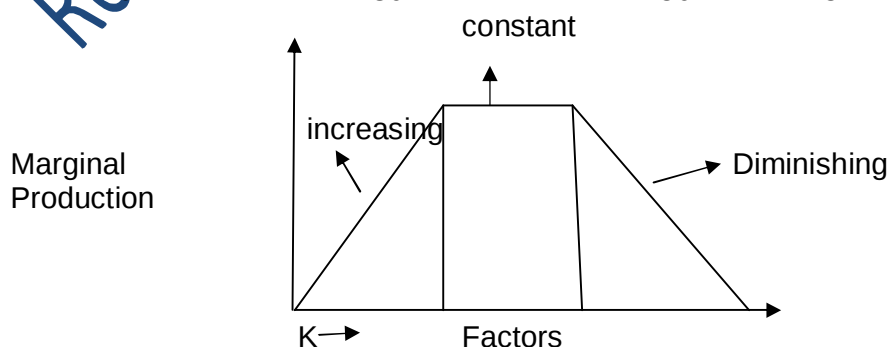
Returns to scale:- It is a long period law in which when a firm changes supply of all the inputs in the same proportion, then initially output increases at increasing rate, then at constant rate & finally at diminishing rate.

Assumptions:

- 1) It is a long period law.
- 2) Fixed & variable factors both are changed
- 3) Units of factors is homogeneous.
- 4) Technique of production is constant.
- 5) Factors proportion will remain constant.

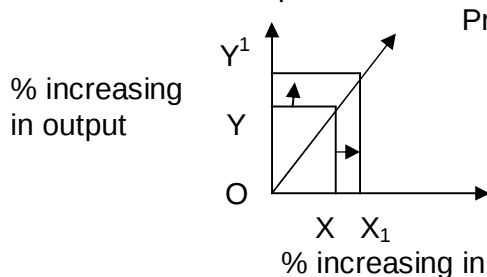
It can be explained with the help of table & diagram.

Factors of cap.	Production labour	TPP	MPP
1	3	5	5
2	6	15	10
3	9	30	15
4	12	50	20
5	15	75	25
6	18	100	25
7	21	120	20
8	24	135	15
9	27	145	10
10	30	150	5

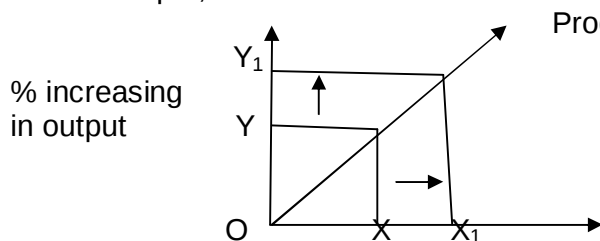


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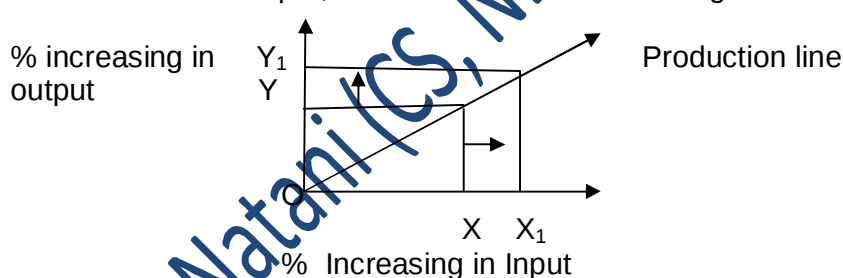
- 1) Increasing returns to scale:- when % increase in output is greater than % increase in input then this is called increasing returns to scale.



- 2) Constant returns to scale:- when % increase in output is equal to % increase in input, then this is called constant return to scale.



- 3) Diminishing returns to scale:- When % increase in output is less than % increase in input, then this is called diminishing returns to scale.



Cause for the application of increasing returns to scale:-

- When a firm increases scale of production from small to large then firm enjoys several benefits of large-scale production. This is called economies of scale. It can be discussed in two parts :-

- a) Internal economies :- These are those benefits which are enjoyed by a single firm due to large scale production. These benefits are as follows:
 - 1) Economies of technique:- When firm increases scale of production from small to large then it can use better technique of production & better technique would give better result. For eg:- textile.
 - 2) Economies of dimension:- When a firm increases scale of operation from small to large, then it has to increase the dimension in which proportionate output will increase more. For eg:- petrol supply in firm. If:-

Diameter of pipe	=	3 cm.
Flow	=	3 x3x3
	=	27 cm ³
Diameter of pipe	=	6 cm.
Flow	=	6 x6x6
	=	216 cm ³

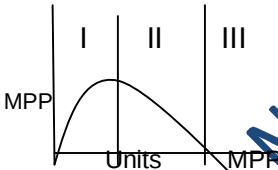
- 3) Managerial economies :- when a firm increase scale of production from small to large, then firm can afford services of better managers which gives better returns for eg:- Reliance.
- 4) Financial economies:- A large scale firm can avail finance facility at cheaper rate of int. As a result firm gets better returns.
- 5) Economies of transport & storage:- at a large scale level transport & storage cost of the firm keeps on diminishing. As a result, firm gets better returns.
- b) External economies:- these are those benefits which are enjoyed by all the firm in a particular area on in a particular industry. These are:
 - Economies of concentration:- when so many firm concentrate in a particular area, then they all get benefit of cheap transport, labor infrastructure & market.
 - Economies of govt. Policies :- whatever benefits are given by the govt. In terms of tax or subsidy would be enjoy by all of the firms.
 - Economies of information:- when latest knowledge or development is done in a particular sector, then this information is shared by all the firms in a particular area through the publication
 - Economies of disintegration :- when production process is divided into several parts & each of the part is taking up by a particular firm & getting specialization then all firms get benefits due to the specialization. For eg:- textile units divided mean in the process like dying, bleaching, weaving & spinning.

Causes for the application of diminishing returns to scale:-

When firm increases scale of production from small to large then after a limit economies of scale is converted into diseconomies of scale.

These are as follows:-

- 1) Diseconomies of management:- When a scale of production increases form small to large then after a point there would be a problem of management, co-ordination & controlling. As a result, firm gets diminishing returns to scale.
- 2) Diseconomies of raw- material :- When scale of operation is increased beyond the point then raw-material availability to the firm would be costly & firm gets diminishing returns to scale
- 3) Diseconomies of technique:- a large- scale production beyond a point may accompany to more technical faults & it gives less returns.

Basis	Returns to factors	Return to scale
Meaning	It is a relationship between change in a variable input to resulted output.	It is a relationship between change in all inputs to output.
Time period	It is for short period	It is for long period
Change in factors	Only variable factors is change i.e. labor	All factor are changed i.e. fixed as well as variable.
Factor ratio	Variable for eg:- Mach labour 1 1 1 2 1 3 1 4	Constant for eg:- Mach labour 1 2 2 4 3 6 4 8
Level's scale of production	Only level of production is changed.	Level's scale of production both are changed.
Stage of production	Increasing diminishing & negative 	Increasing constant & diminishing 