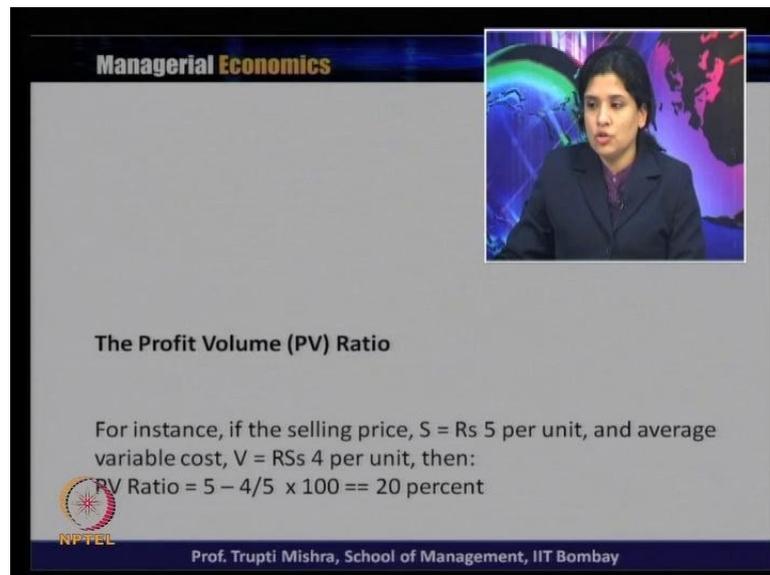


**Managerial Economics**  
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**Lecture - 44**  
**Theory of Cost (Contd..)**

Next, we look at the profit volume ratio. So, profit volume ratio is another useful tool for finding the breakeven point for sales, especially, for the multipurpose firm. So, this is the breakeven point in the short firm is known as BEP. that is, of sales especially for the multipurpose firm and what is the PV ratio,  $PV\ ratio = \frac{(S - V)}{S} \times 100$  whereas, S is the selling price, V is the average variable cost. So, the profit volume ratio is the difference between the selling price and the average variable cost and this is PV ratio is generally use as the breakeven point for the sales particular in the multipurpose firm.

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**The Profit Volume (PV) Ratio**

For instance, if the selling price, S = Rs 5 per unit, and average variable cost, V = Rs 4 per unit, then:

$PV\ Ratio = 5 - 4/5 \times 100 == 20\ percent$

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So, if you the selling price is the S is equal to 5 unit the average variable cost is V is equal to the rupees 4 unit then P V ratio is selling price that  $PV\ ratio = \frac{(5 - 4)}{5} \times 100$  that is 20% we can say that 20% is the *PV ratio*.

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$A = 25\%$   
 $B = 40\%$   
 $B \rightarrow A$

product	A	B
Selling price	2	2.5
variable cost per unit	1	1.5
Machine hour per unit	2	1.0

PV ratio for B  

$$\frac{S-V}{S} \times 100$$

$$= \frac{2.5-1.5}{2.5} \times 100$$

$$= \frac{1.0}{2.5} \times 100$$

$$= 40 \text{ percent}$$

PV ratio for A =  $\frac{S-V}{S} \times 100$   

$$= \frac{2-1}{2} \times 100$$

$$= \frac{1}{2} \times 100 = 50 \text{ percent}$$

PV ratio =  $\frac{2-1}{2} \times 100 = 50 \text{ percent}$   
 $A = 50/2 = 25 \text{ percent}$

Then, we will take another example to understand this PV ratio. Suppose, we have a product then, two products since we are saying multipurpose firm. So, A and B we will take a selling price here and we will take variable cost per unit and we will take machine hour per unit. So, in case of selling price in case of A this is 2, in case of this is 2.5. Variable cost per unit is 1 in case of A, 1.5 in case of B. Machine hour per unit is 2 in case A and 1.0 in case of B.

Now, to find out the PV ratio for a PV ratio for A will take selling price minus variable cost

upper selling price multiplied by 100. So, this will  $PV \text{ ratio of } A = \frac{(2-1)}{2} \times 100$  that gives to

50 percent. So, 50 percent is the breakeven level price that is to the PV ratio. So, now, to find out the PV ratio per mission hour because if you look at machine hour is two unit. So, in this case to find out the PV ratio for each machine hour PV ratio per a for each machine hour this 50 percent will be divided by 2 that is 25 percent. So, 25 percent is the PV ratio and that leads to the break even sales price of the breakeven price for the sales similarly how to find out the

PV ratio for B again ,  $PV \text{ ratio of } B = \frac{(S-V)}{S} \times 100$ . So, there it comes to

$PV \text{ ratio of } B = \frac{(2.5-1.5)}{2.5} \times 100$  that comes to 40 percent. So, PV ratio will be 40 percent

and since this is the machine hour is only one this the total PV ratio in term of the machine hour also.

In case of A, the PV ratio is 25 percent. In case of B, the PV ratio is 40 percent. So, in this case B will be preferable to A or in other words, we can say the firm will get more breakeven or more get profit from B as compared to the A, because the PV ratio is more in case of B compared to A and PV ratio is nothing, but the difference between the selling price and the variable cost of production. So, the larger is the variation more profit to the firm because that finally, lead to the breakeven price for the sales for the typical product.

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The Break-even point (BEP) in sales value is calculated by dividing the fixed expenses (F) by the PV ratio.

$$\text{BEP (Sales value)} = \frac{\text{Fixed Expenses}}{\text{PV Ratio}} = \frac{F}{S} - \frac{V}{S}$$

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Then, we will discuss about the. So, the breakeven point in the sales men which calculated by dividing the fixed expenses saved by the PV ratio. So, BEP sales value is the fixed expenses

by PV ratio which is equal to  $\text{BEP}(\text{sales value}) = \frac{\text{Expenses}}{\text{PVratio}} = \frac{F}{S} - \frac{V}{S}$

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**Managerial Economics**

**Margin of Safety**

It represents the difference between the sales at breakeven point and the total actual cost.

Margin of Safety = Profit \* Sales/PV ratio  
 Margin of Safety = Profit/ PV ratio  
 Margin of Safety =  $S_a - S_b/S_a * 100$ ,  $S_a$  – actual sales,  $S_b$  = sales at BEP - Example

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Then, we will talk about the margin of safety and margin of safety generally represents the difference between sales and breakeven point and total actual cost. So, the difference between the sales and the breakeven point and the total actual cost will leads to the margin of safety. There are three majors to this margin of safety one that is profit multiplied by sales by PV ratio, second profit by PV ratio and third margin of safety is  $S_a - S_b / S_a \times 100$  where  $S_a$  is the actual sales  $S_b$  is the sales at the BEP.

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The handwritten notes on the slide are as follows:

**Margin of Safety**

Actual Sales  $\uparrow$       break even sales  $\uparrow$

$$MOS = \frac{S_a - S_b}{S_a} \times 100$$

$$MOS = \frac{20 - 10}{20} \times 100 = 50\%$$

$S_a \uparrow \rightarrow$  demand for in. elastic

**Margin of Safety**

$$TR = 10Q$$

$$TC = 50 + 5Q$$

$$S_a = 20$$

$$TR = 10S_b$$

$$TC = 50 + 5S_b$$

$$TR = TC$$

$$10S_b = 50 + 5S_b$$

$$10S_b - 5S_b = 50$$

$$5S_b = 50$$

$$S_b = 10$$

So, we will just take a example to understand this margin of safety. So, here total revenue is  $10Q$ , total cost is  $50 + 5Q$  and  $S_a$  is  $20$ . So, given the total revenue and total cost from sales and BEP,  $S_b$  can be if you look at. So, total revenue is  $10 S_b$  and total cost is  $50+5 S_b$  because this is a sales at the breakeven level of output which is equal to  $Q$  then at the breakeven point is equal to total cost. So, substituting the value of total revenue and total cost that is  $10 S_b = 50 + 5 S_b$ . So,  $10 S_b - 5 S_b$  which is equal to  $50$ . So,  $5 S_b$  is equal to  $50$  and  $S_b$  is equal to  $10$ .

Now, in order to find the margin of safety we know that  $S_b$  is equal to  $10$  and  $S_a$  is equal to

$20$ . So, following the third margin of safety is  $\frac{S_a - S_b}{S_a} \times 100$  will give us the margin of safety

here  $S_a$  is the actual sales this is the breakeven sales. So, corresponding to this we will get margin of safety is equal to  $20$  minus  $10$  that is  $20$  multiplied by  $100$  which is equal to  $50$  percent. So, this margin of safety can be increased by increasing the selling price provided that demand of product is inelastic. Because if it is elastic then small change in the price is going to get influence by the consumer and they will change the demand pattern.

So, the margin of safety is the difference between the actual sales and the break even sales. And break even sales and can be find out from total cost and total revenue. So, margin of safety in the last class will look at the more is the actual sale that is  $S_a$  that more is the margin of safety.

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**Margin of Safety**

- It can be increased by increasing selling price, provided the sales are not seriously affected.
- It can happen only when demand for the product is inelastic.
- It can also be increased by increasing production and sales up to the capacity of plant even by reducing selling price provided the demand is elastic.

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So, it can be increased by increasing the selling price. The sales can be increased by increasing the selling price provided, the sales are not seriously affected and it can happen only when the demand for product is inelastic. Because if it is elastic, whenever there is change in the change in the price selling price that leads to effect the demand in one way. That will reduce the sales the quantity of the sales also this margin of safety can be increased by increasing the production. And sales up to the capacity of the plan even by reducing the selling price provided the demand is elastic.

So, it can be also increased by increasing the production and sales up to the capacity of plan even by reducing the selling price and here again the precondition is the demand is elastic.

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**Margin of Safety**

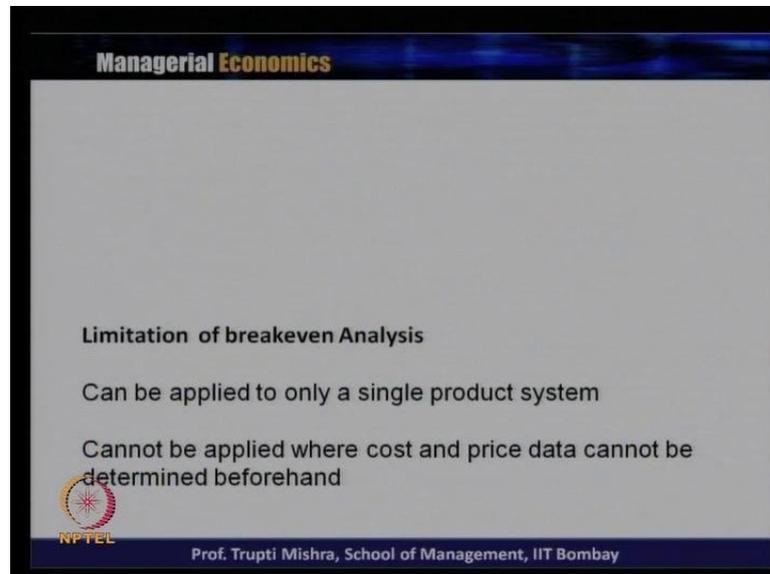
The other methods include reduction in fixed expenses, reduction in variable expenses or having a product mix with greater share of one that assures greater contribution per unit or which has a higher PV ratio.

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So, this for a margin of safety, the other method includes the reduction in the fixed caption's in order to increase the margin of safety. The other methods to increase the margin of safety is to reduction in the fixed expenses, reduction in the variable expenses or having a product mix with the greater share of one that assure a greater contribution per unit which has a higher PV ratio the profit volume ratio.

So, either the margin of safety can be increased by reducing the fixed expenses. Reducing the variable expenses or using the product is which keeps more contribution. That is more than the fixed cost and also a higher PV ratio the profit volume ratio. So, margin of safety will be increased by reducing the expenses; both fixed expenses and the variable expenses or get it share of contribution of the greatest value of the PV ratio.

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**Managerial Economics**

**Limitation of breakeven Analysis**

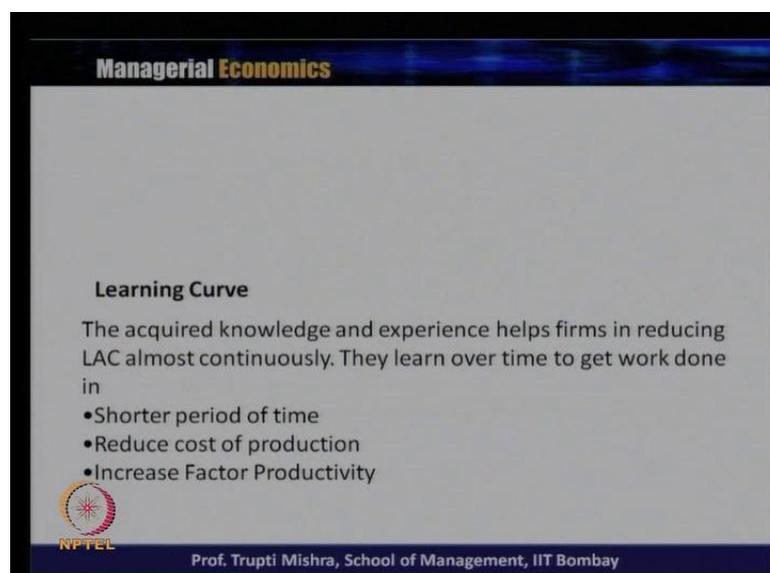
- Can be applied to only a single product system
- Cannot be applied where cost and price data cannot be determined beforehand

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So, when it comes to this break even analysis, whether it is a contribution analysis through the PV ratio or through any other method, if you look it can only be applied to the single product system or can it be applied when the cost and price data cannot be determined beforehand. So, there is a limitation to the break even analysis. If its applicable only to the single product system and it can be applied only if the cost and price data is known before hand.

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**Learning Curve**

The acquired knowledge and experience helps firms in reducing LAC almost continuously. They learn over time to get work done in

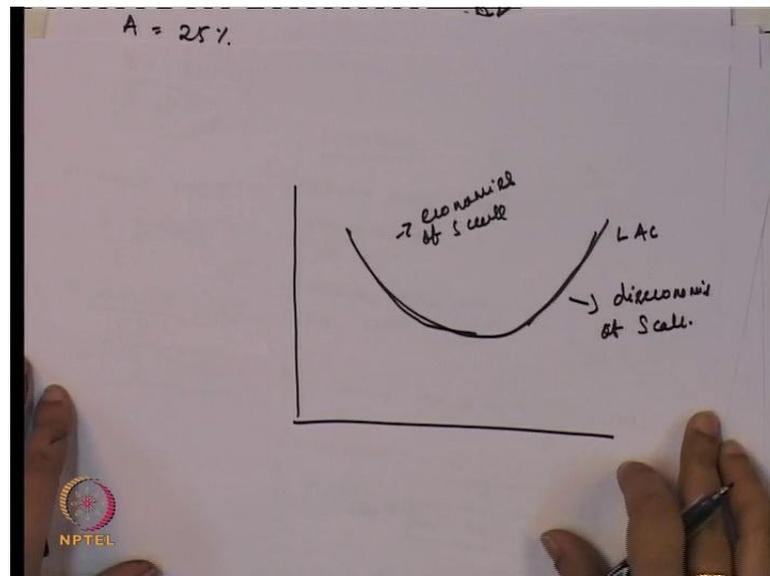
- Shorter period of time
- Reduce cost of production
- Increase Factor Productivity

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Then, we will talk about the concept of learning curve and if you look at we are going on discussing one fact across this session that this long run average cost curve is U-shaped.

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In the U-shape this decreasing part because of economy of scale the reduce cost is because of economy of scale and the increasing part is because of diseconomic of scale. But, if you look at there may be other reason through almost must be understand that this reduced cost it not only because of economic of scale or the increase cost is not because of diseconomic of scale. There may be few other factors which influence the increasing and decreasing average cost of production when there is the scale of output increases. So, one of the fact here is that the acquired knowledge and experience farm reducing the long run average cost curve most continuously they learn about time to get work done about shorter period of time, reduce cost of production and increase cost of time is the fact of productivity.

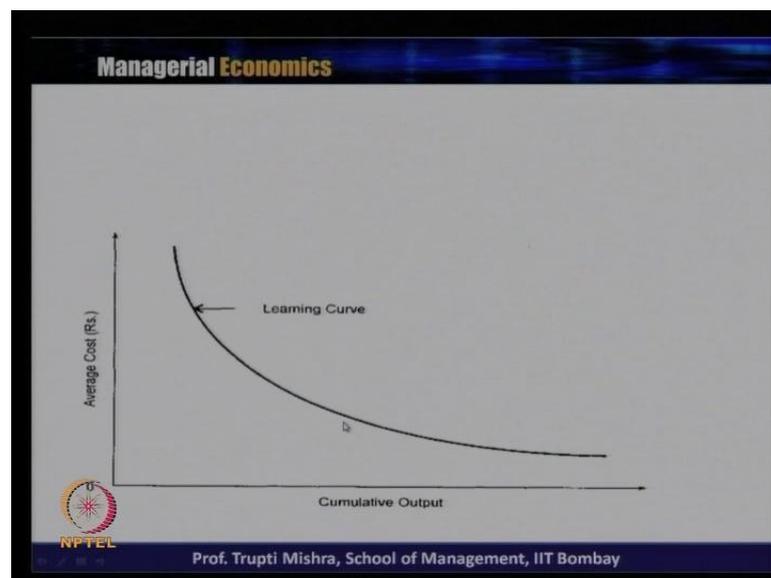
Like, if you take the case of labour, if you take the case of capital I think when you the opinion of the farmer. The opinion of the learning prominent of learning is that, when the firm does the same type of production over a period of time they get experience in doing that and that leads to less time that leads to less cost of production and increase the factor or productivity. So, the efficiency of the inputs increases the efficiency of the firm increases and that is the reason the cost is decreasing. So, the learning cost, the theory we had learning cost is, that it's not because of economics of scale or the diseconomics of scale. There is one more

fact that the knowledge and experiencing in doing the same kind of activity, they learn through and that leads to the average cost decreases. Suppose, some are new to operate that machine and if the labour is operating that machine over a period of time, he gain the scale again. He gains the exposure to operate this operate the machine and he is doing the whatever time is requiring time request to operate the machine. That is come down and may be also the productivity of the labour increase because in the same time he can do something else.

Now, similarly if you look at the process itself, the process itself the initially there is a time to fix up or set up the process. But in the long run when you do it over a period of time, the process is set up the system is in place and that leads to less time and the inputs become more productive.

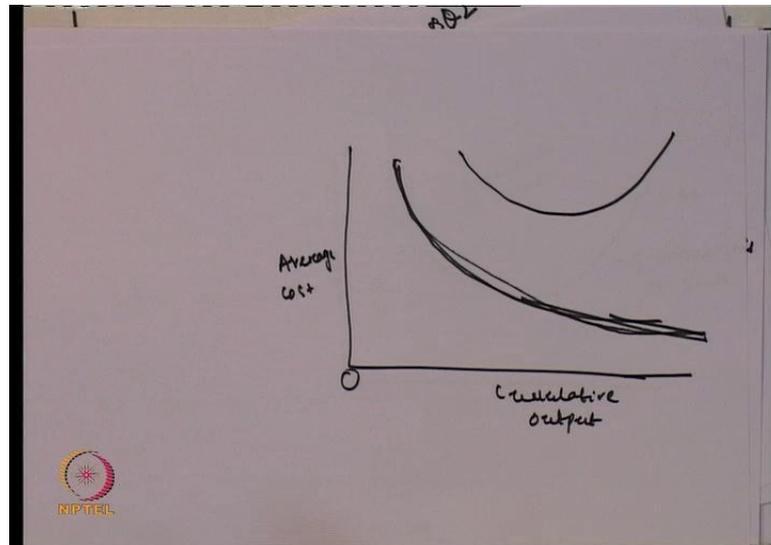
So, in case of learning curve the opinion is that the one knowledge and experience help the firms to reduce the average cost. And that leads to the shorter period of time reduce cost to the production and increase the factor productivity.

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And this learning curve is one that is applicable to the accumulative output and it's not the output. May be, average output the major difference between the long run average cost curve and the learning curve is in case of long run average cost curve. We take the average cost of production with the increase in the scale of output. But in case of learning curve we take the accumulative of output that is the total product from the beginning of the stage.

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So, if you look at this curve is showing a decline trained in the. So, if this is the learning curve its decreasing, but in case of long run average cost curve it always increases after a point. But in case of learning curve in case of learning curve it the cumulative cost, cumulative output in case of average cost goes on decreasing there is no shine to increase the cost of production when the scale of output increases.

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The curve shows declining trend in long-term average cost of production.

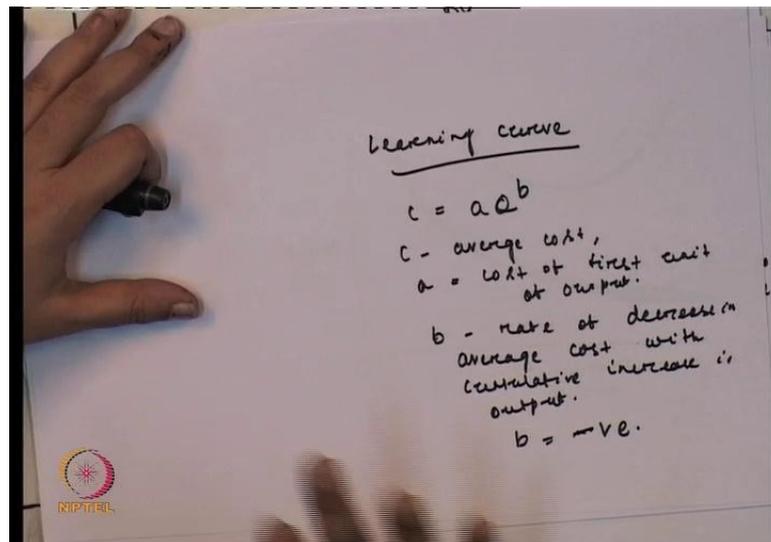
Learning curve is different from convention LAC as LAC gives cost of Plant wise production, Learning curve gives average cost of cumulative output., the total output right from the beginning of production of a commodity

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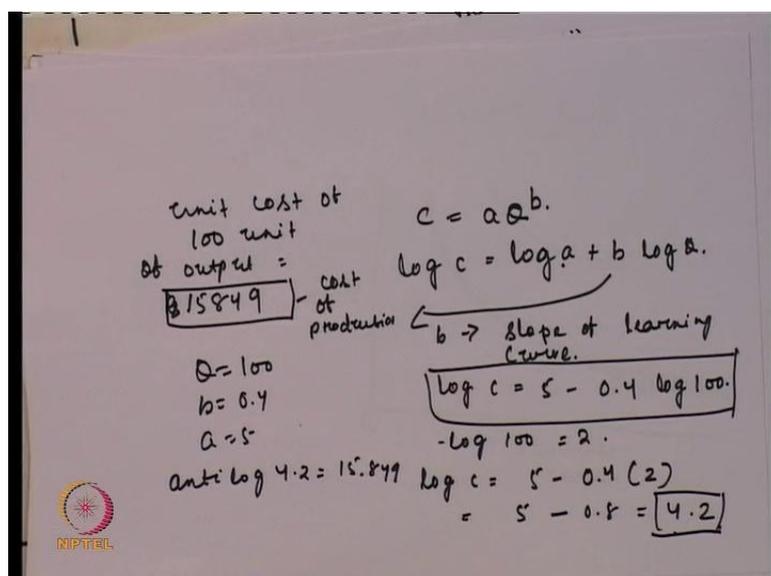
So, this curve shows the declining trained in long term average cost of production and learning curve is different from the conventional long run. Average cost curve as long run average cost curve gives the cost of plan wise production learning curve gives the average cost of cumulative output.

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The total output right from the beginning of the production from the cumulative. Now, we will say we will take a small numerical to understand this learning curve or we will do the or will estimate the unit of the learning curve. So, if you take a cost function where  $c = aQ^b$  where, c is the average cost and Q is the average cost of unit of output Q, a is the cost unit of output and b is the rate of decreasing rate of decreasing average cost with cumility of increasing output. The value of b is negative because decrease in Q will always increase the or may be decrease in the cost with cumulative will increase in the output the greater the value of b the first one is the decrease in the average cost.

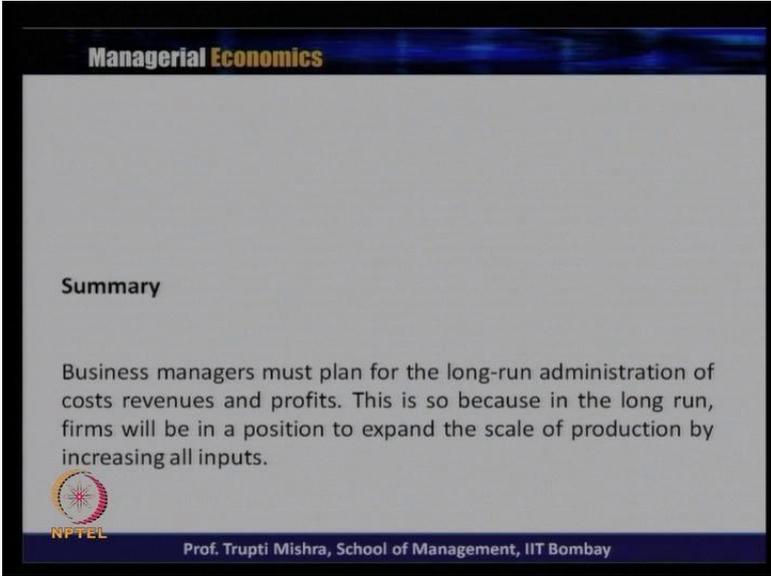
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So, this learning curve this  $c = aQ^b$  can be converted into a logarithmic form that is  $c = aQ^b$ . So, this can be  $\log c = \log a + b \log Q$ . So, b gives the slope of the learning curve b gives the slope of the learning curve, a is the intercept. So, if you look at this if you take this  $\log c = 5 - 0.4 \log 100$ . Suppose, if we assign the value of Q is equal to 100, b is equal to 0.4 and a is equal to 5. Then this equation is  $\log c = 5 - 0.4 \log 100$  and since log of 100 is 2. Then we can again this equation as  $\log c = 5 - 0.4(2)$  and which is equal to  $5 - 0.8$ , which is equal to 4.2.

So, if you take an antilog of 4.2 then, that comes to 15849 and if you summarize this then unit cost of 100 unit of output equal to 15849 is the cost of production. Similarly, you can find out for any level of output that is, you can find out the cost for any level of output simply changing the value of Q and getting the value of log a and log b.

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**Summary**

Business managers must plan for the long-run administration of costs revenues and profits. This is so because in the long run, firms will be in a position to expand the scale of production by increasing all inputs.

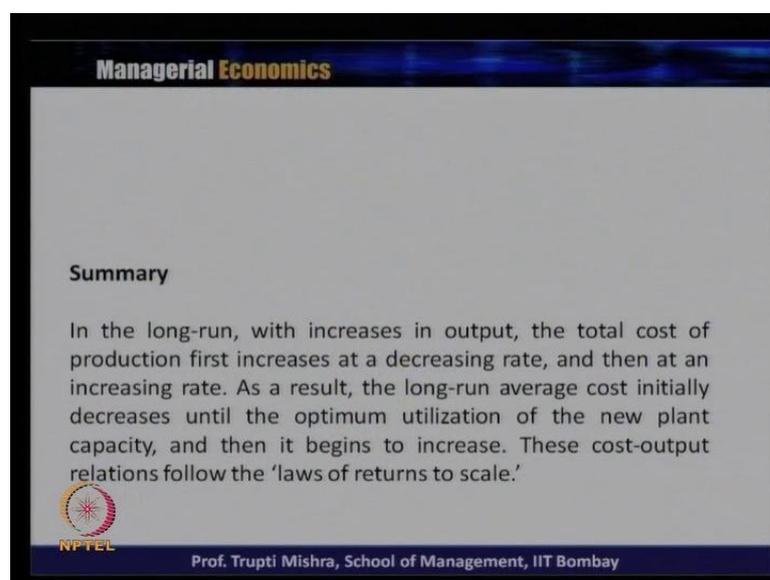
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So, if you summarize whatever we discussed today, taking this break even analysis learning curve and p v ratio. The business manager must plan for the long run addition of the cost revenue and profit and because in the long run firm in the position to expand the scale of production by increasing all inputs. So, the it is a kind of scenario analysis. It's a kind of long

term horizon how the firm because the firms decision firms business decision firms depends upon the cost and revenue because that gives us the profitable and non profitable range of output.

Firms are assume to plan the production activity much better level of production for which total cost and total revenue breakeven is known and this employees the profitable and non-profitable range of output.

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**Managerial Economics**

**Summary**

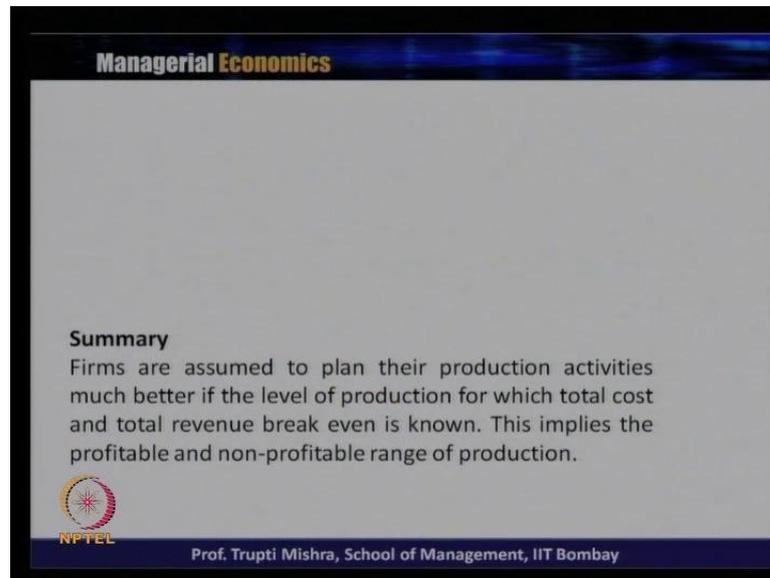
In the long-run, with increases in output, the total cost of production first increases at a decreasing rate, and then at an increasing rate. As a result, the long-run average cost initially decreases until the optimum utilization of the new plant capacity, and then it begins to increase. These cost-output relations follow the 'laws of returns to scale.'

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So, in the long run with the increase in output, the total cost of production first increases at the decreasing rate then at an increasing rate and As a result of long run as the average cost initially decreases until the optimum utilization of new plant capacity and then it began to increase. And the cost and the output relation always follow a loss of return to scale and that is the reason the long run average cost for which show a usage. So, the decreasing part of the long run average cost per decrease the economic scale and long run increasing part is because of diseconomic of scale.

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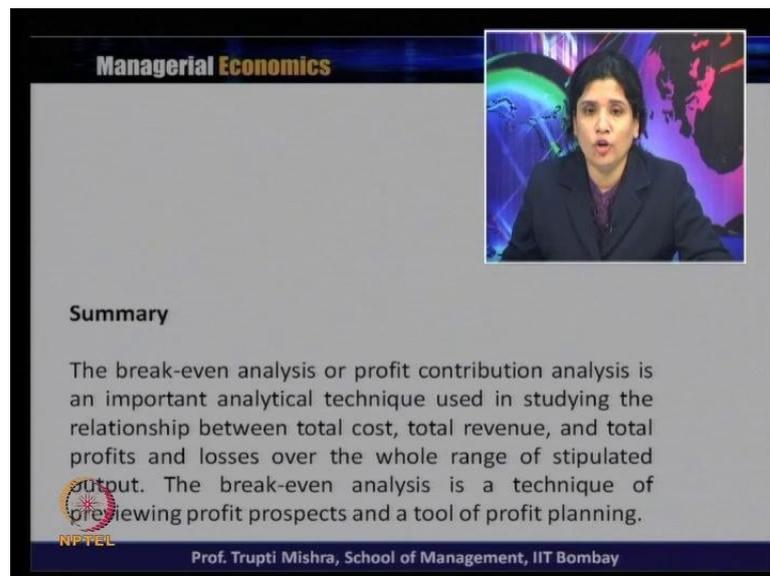


**Managerial Economics**

**Summary**  
Firms are assumed to plan their production activities much better if the level of production for which total cost and total revenue break even is known. This implies the profitable and non-profitable range of production.

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**Managerial Economics**

**Summary**  
The break-even analysis or profit contribution analysis is an important analytical technique used in studying the relationship between total cost, total revenue, and total profits and losses over the whole range of stipulated output. The break-even analysis is a technique of previewing profit prospects and a tool of profit planning.

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So, we analyse the break-even analysis for both linear and the non-linear total cost and revenue analysis. So, the break-even analysis or the profit contribution analysis is the analytical technique used in studying the relationship between the total cost total revenue total profit and losses over a range of stipulated output. And basically there is a technique of previewing the profit prospect and tool of planning.

So, if you remember in case of linear cost and revenue, we get one breakeven level of output where the profitable range of output is unlimited. But in the real life, this is not possible to get

a unlimited range of output that brings the nonlinearity in the total revenue and the total cost function. And in case of non-linear and total cost function, we get two breakeven level of output. So, rather than getting a profitable range of output, we get a upper limit and lower limit for the profitable range of output. Then we discuss about the PV ratio and the PV ratio which is specifically deals and the contribution analysis, which specifically deals with the incremental revenue and the incremental cost. Incremental revenue and incremental cost comes to the fact well, we cannot do the analysis with the marginal cost and marginal revenue where the per unit change is not possible. In this case the contribution is the guiding factor for the business manager to decide the range of output.

So, in case of contribution analysis beyond the before the break even analysis the breakeven level level of output the contribution is less than fixed cost. That is, where the firm incur loss, but in case of beyond the breakeven level of output the contribution is more than the fixed cost and that leads to the profit. So, here in case of incremental analysis, the guiding factor is the contribution and that helps the manager to decide whether to go for that range of output or not. And finally, we discuss about the learning curve which is alternate to the economic of scale is the reason behind the decreasing cost of production and here it is different from the long run average cost curve because the learning curve is one where the average cost goes on decreasing for the accumulative output. And that achieve through the productivity of the factor input. So, we will continue our discussion on this cost again typically on economics and diseconomics of scale in the next session and for preparing this session which are the session differences that has been exclusively followed for this.