Managerial Economics
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Lecture - 23
Theory of Cost (Contd…)

In today's session we will continue our discussion on the Theory of Cost, we are towards the end of theory of cost which talks about, and the economies of scale. And the economies of scale, if you remember in the last class also we discussed, the basis for that why there is a use of long run average cost curve.

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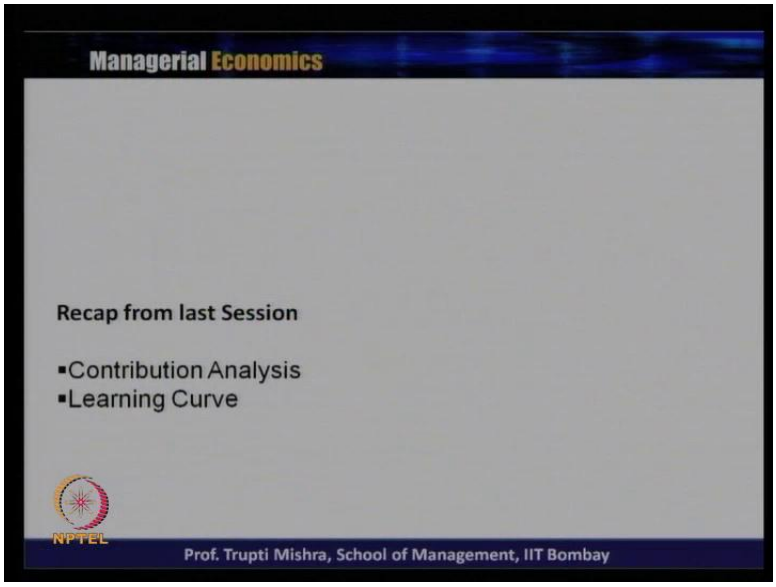

So, in the previous class we discuss about different cost analysis like short run and long run cost analysis, then we discussed that why long run average cost curve is u shaped, what is the evidence of economies of scale, and diseconomies scale. And in the different kind of average cost, then we talked about the contribution analysis specifically the p v ratio, and then we talk about the learning curve, if you look at that is the other way to analyze the long run average cost curve.

So, in one case we say that, when there is a economy of scale long run average cost curve is u shaped, because there is a economies of scale. And this economies of scale whereas, in this case of learning curve, the long run average cost goes on decreasing and there is no point where it increases again. So, in today's class we will focus more on the

or mostly on the economies of scale, different types of economies of scale, how the large firms or how the large large production amount bring some brings some cost advantages, and that is how the the firm produces at a lower unit to cost production that is how we are going to discuss today.

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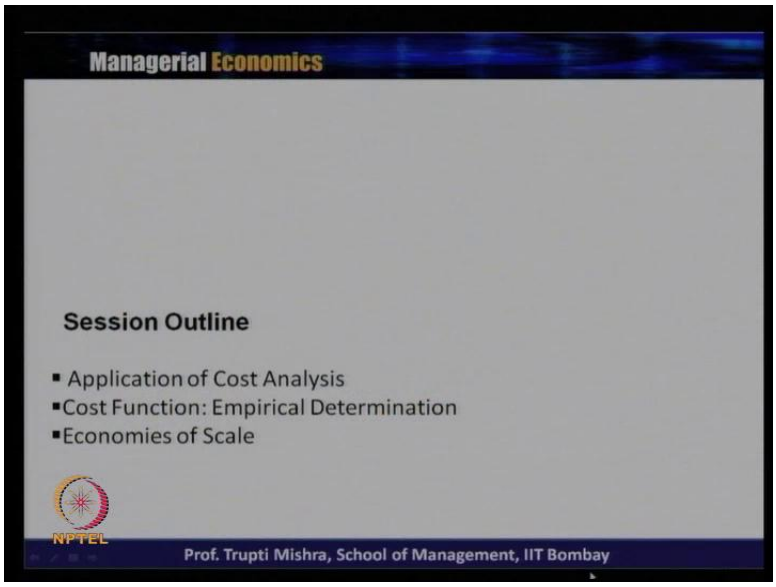

So, the focus or the session coverage is application of the cost analysis, we will take some the cost function the empirical determination of it, and then we will talk about the economies of scale.

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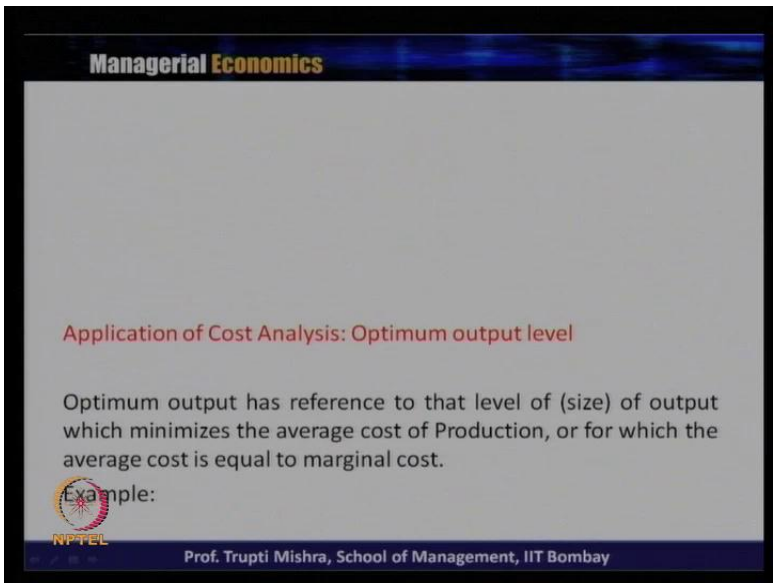

So, application of cost analysis if you look at this is the, (( )) first case in case of optimum output level, we generally use the cost analysis to identify what is the optimum output level. So, optimum output has the reference to that level of that level of size of output, which minimizes the average cost of production, and for which the average cost is equal to the marginal cost. We have discussed several time this optimal production or optimal output, optimal output is one which can be produced at a lowest minimum cost that is the basic understanding of the optimal output.

And here if you look at optimal output is that level of output, which minimize the average cost of production, because here we are trying to fit the optimal output taking the constant as the average cost of output. So, optimal level of output is 1 which produce a produce that level of output which minimizes the average cost of production or maybe the another condition for is that, where the average cost is equal to the marginal cost. So, we will just take a example that, how to find out empirically taking a typical cost function, how to find out the optimal optimal output level which minimize the average cost at that point of time.

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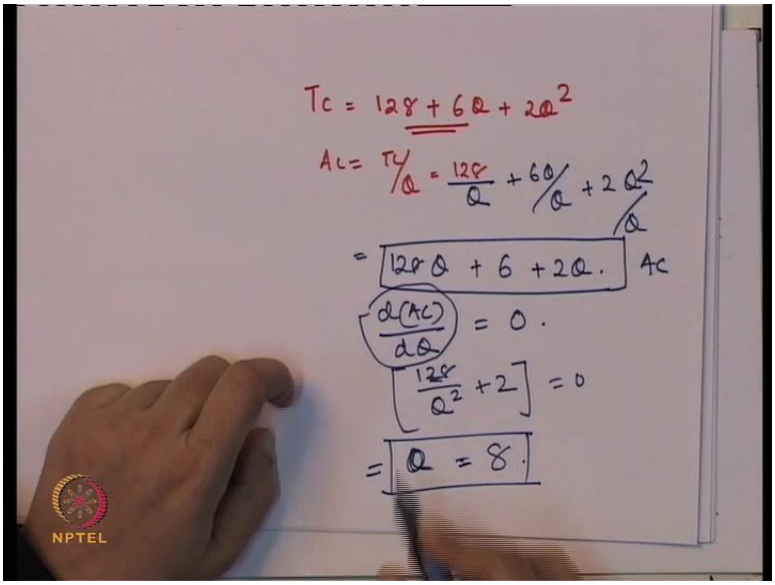

So, if you will take a cost function like that is total cost is equal to 128 plus 6 Q plus 2 Q square, if this is the cost function, then in order to find average cost as we know this is total cost divided by Q, so this is 128. So, generally when we find this average cost, we generally divide it by that the unit of output, so this is 128 by Q plus 6 Q Q plus 2 Q

square Q, so that comes to 128 Q plus 6 plus 2 Q, so this is the average cost, this is the average cost for the cost function.

Now, to find out at which point average cost is minimum, we need to take the first order derivation that is first order derivative of average cost with respect to Q. And if you equalize that equal to 0, then this comes as 128 Q square plus 2 which is equal to 0, and if you summarize or simplify it again we get Q is equal to 8. Now, how do you interpret this Q is equal to 8, so when we know that average cost is minimum average cost is minimum mathematically, we can find out that by taking the first order derivative of average cost with respect to Q.

If you take this with respect to 120 Q plus 6 plus 2 Q, in this case we get the Q value of Q which is equal to 8, and value of Q if it is equal to 8, then this is the level of output where the average cost is minimum. Now, let us understand the same cost function, taking in term of the marginal cost or when we find out the marginal cost and equalizing the marginal cost and average cost again, whether we get the same level of output, where the cost of production or the where the average cost is minimum.

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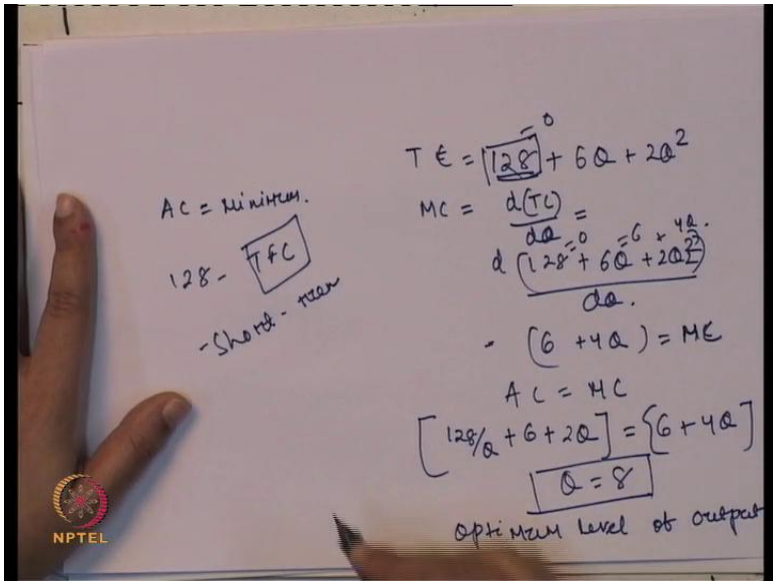

So, taking the same cost function again, suppose this is total total cost is equal to 128 plus 6 Q plus 2 Q square, here will find out the marginal cost and how to find out the marginal cost? Generally we will take the first order derivation of total cost with respect to d Q. So, in this case how do you find out this, so this term becomes 0 d 128 plus 6 Q

plus 2 Q square as compared to with respect to d Q, so if you do this, then this term is equal to 0 calculus. So, this is equal to 6 and this is equal to 4 Q, so 6 plus 4 Q is our marginal cost, we have average cost, we have we have marginal cost.

Now, if you equalize this average cost is equal to the marginal cost, then in this case what is the value we are going to get, as we know the average cost is 128 Q plus 6 plus 2 Q, because this is nothing but T C divided by Q which is equal to 6 plus 4 Q. So, if you if you make a equalization of average cost and marginal cost and simplify this, then again we get a value of Q which is equal to 8, so Q is, Q 8 is what Q 8 is the optimum level of output Q eight is the optimum level of output, where average cost is minimum. And we can say that this is a short run cost, because we have some amount of 128 over here.

So, what is 128, 128 is the total fixed cost, and if you remember we get the amount of fixed cost only in case of short run, so since it is a case of total fixed cost, we can say this is a short run analysis. In case of short run cost analysis, Q 8 is the level of output or 8 is the level of output where the average cost is minimum. So, the point over here we want to focus is that, what is the role of this average cost, marginal cost or total cost or how it helps in taking the economic decision and business decision, or how it helps to generally using it for the different kind of economic analysis.

So, for to summarize this we can say that optimum output level is 1, where the average cost, where the cost to be minimum and that we can check from a cost function by taking the taking out the average cost, the marginal cost, and solving the value for the Q.

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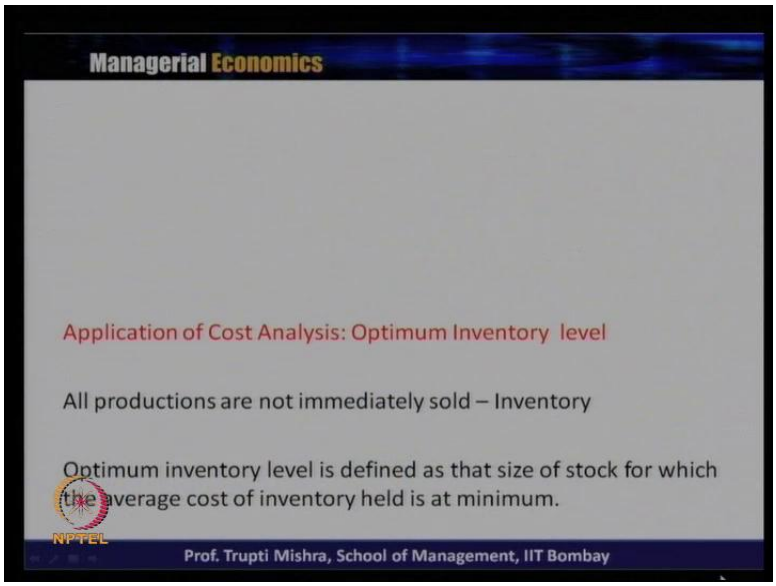

So, next will see this optimum cost analysis in case of the optimum inventory level, so when this concept of inventory comes generally, inventory comes if all the production are not immediately sold. And if you look at whatever is produced, and whatever is sold there is a gap in between and the gap whatever the amount, that generally goes to the warehouse, that is generally goes to the stock. And in economics term we called it as the inventory, because that is the stock kept in the warehouse which is not coming to the open market for getting sold.

Now, how to define the optimum inventory level? Optimum inventory level is defined as the size of stock for which the average cost of inventory is minimum; so if you look at it is just generalized into the same concept of optimum output level is generalized in to the optimum inventory level. And what is in optimum inventory level? The size of the stock or the size of the inventory where the average inventory cost is generally minimum. So, the way we analyze the optimum output level that is that is the level of output where average cost is minimum; in similarly here it is the level of stock where the where the average inventory average cost of inventory is generally minimum.

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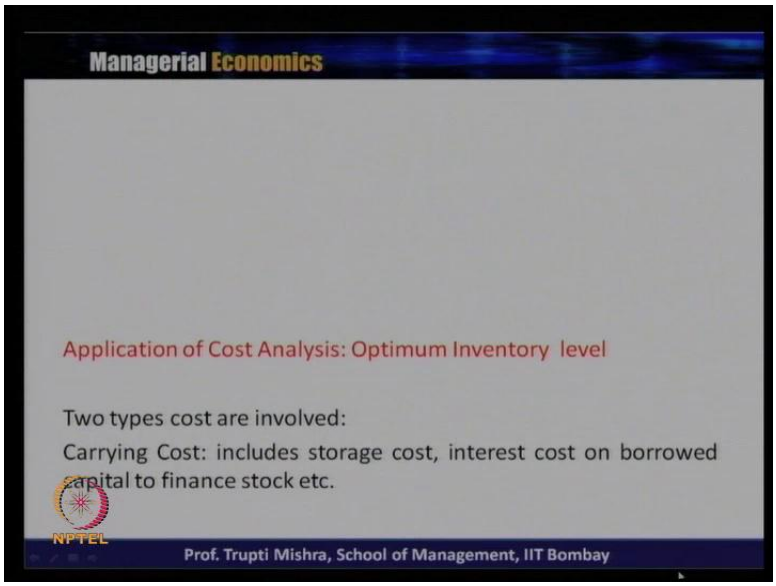

So, let us look at how to find out the optimum inventory level, so there are two types of cost involved over here, one that is carrying cost, generally it includes the storage cost, interest cost on borrowed capital to finance stock etcetera. And second type of cost is reorder cost which includes the book keeping cost, telephone charges, and some variable cost. So, there are two kinds of costs are involved in case of a when they are finding out the optimum inventory level, one is the carrying cost and second one is the reorder cost; both has to be the part of the cost function, when we are finding out the optimum inventory level.

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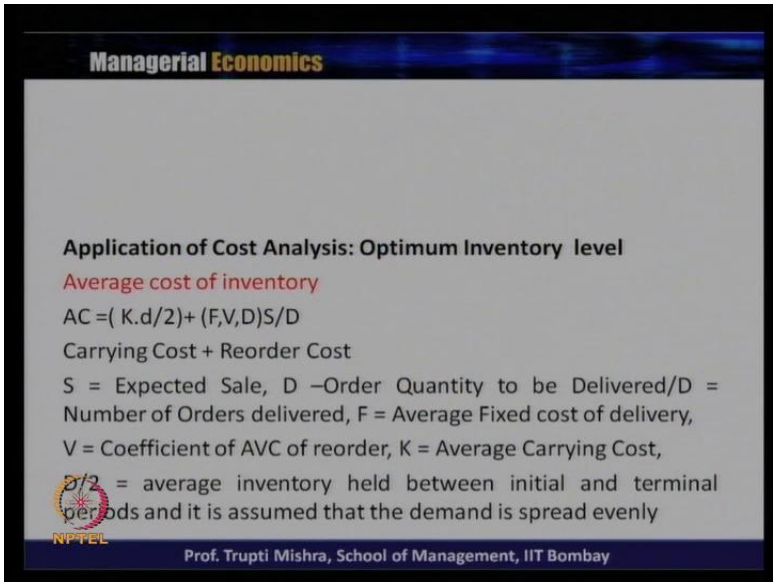

So, average cost, how to find out the average cost of inventory, the average cost of inventory is K multiplied by d by 2 plus F plus V plus D S divided by D, so the first part of this equation is the carrying cost, and the second part of this equation is the reorder cost. Now, we will see what is the terminologies stands for, S is the expected sale, D and why we are taking the expected sale, because that will tell us that which are which is the what are the amount that is going to be sold, and what are the amount that is going to be stock or that is going to be in the inventory.

So, S is the expected sale, D is the order quantity to be deliver, and D is the number of orders deliver, F is the average fixed cost of delivery, V is the coefficient of AVC of reorder and K is the average carrying cost . So, if you look at this average cost consist of both carrying cost and reorder cost, and different types of cost either coming under carrying cost or reorder cost that is added in the equation.

And what is D by 2 that is the average inventory held between initial and terminal period, and it is assume to that the demand is spread generally evenly. Because this is since we need to find out what is the average inventory cost, we also need to find out the average inventory level; and that is the reason we bring this D by 2 variables in to our average cost function. And D by 2 is nothing but the average inventory held between the initial and terminal period, and it is assumed that the demand is spread evenly. Now, to find out the optimal inventory level held at any point of time generally we do the first order derivative that is for the average cost has to be equal to 0.

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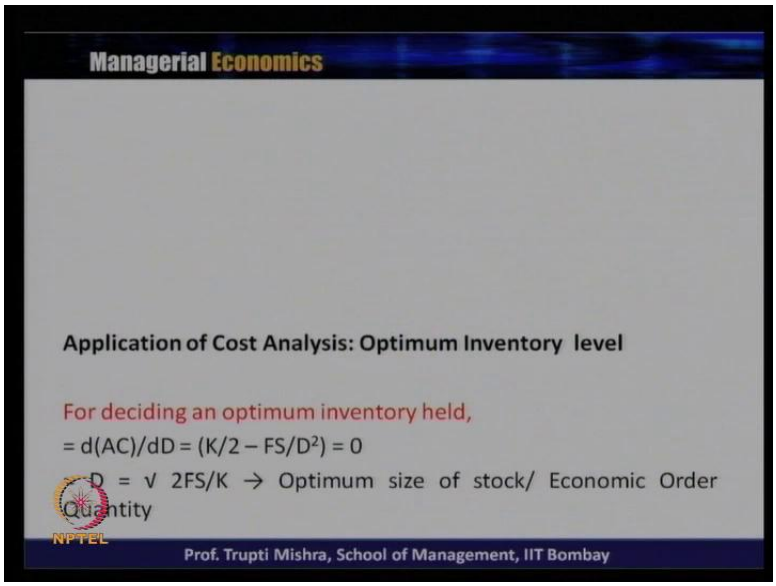

So, d A C with respect to d, so if you take a first order derivative of average cost with respect to capital D, then it comes to K by 2 minus F S D square, which has to be equal to 0. If you simplify this for the capital D that is root 2 F S by K, and this gives us the optimum size of stock or the economic order quantity, so popularly this is known as the economic order quantity, and this is the optimum size of stock.

So, D how how do you find it generally we take the average cost that is the first order derivative, we take the first order derivative of the average cost with respect to the capital D equalize it to 0. And then we solve it for D, capital D and that gives us the optimum size of the stock, or that gives us the economic order quantity, so that D comes to be root 2 F S by K.

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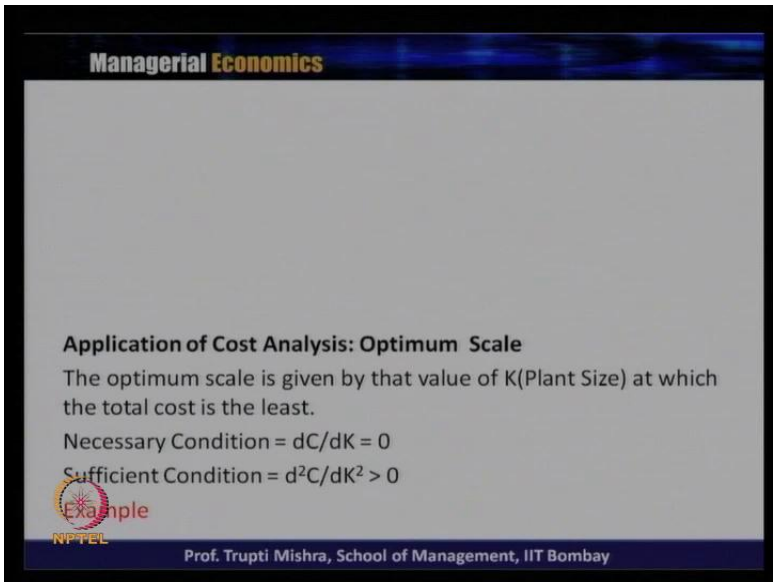

Now, we will look at the application of cost analysis in case of the optimum scale, in the first case we talk about the optimum output, how this cost analysis is used in the optimum output, then we check that how this cost analysis is used in case of the optimum inventory level. Then we will say to identify the plant size, to identify the scale of operation that is the, what should be the optimum scale, what should be the optimum size, what should be the optimum optimum level where the firm should operate? And will see the use of cost analysis is being there, so the optimum scale is give by the K, that is plant size at which the total cost is less.

So, if you look at there is a significant difference here, from the application of cost analysis here in the last two cases that is optimum output and optimum inventory. Because in previous both these cases, we identify that level of output or the level of stock, where the average cost was minimum, but here we are saying that the optimum scale was given by the value of K or by the plant size at which the total cost is the least.

Now, what is the necessary condition for this optimum scale, the necessary condition for this optimum scale is d C by d K is equal to 0; that is also known as the first order condition that is d C by d K has to be equal to 0, so first order derivative essentially has to be equal to 0. And sufficient condition is d square C by d K square greater than 0 that is the second order condition, where it has to be greater than 0. Now, will take an

example to understand that how to use this cost analysis in order to identify the optimum scale.

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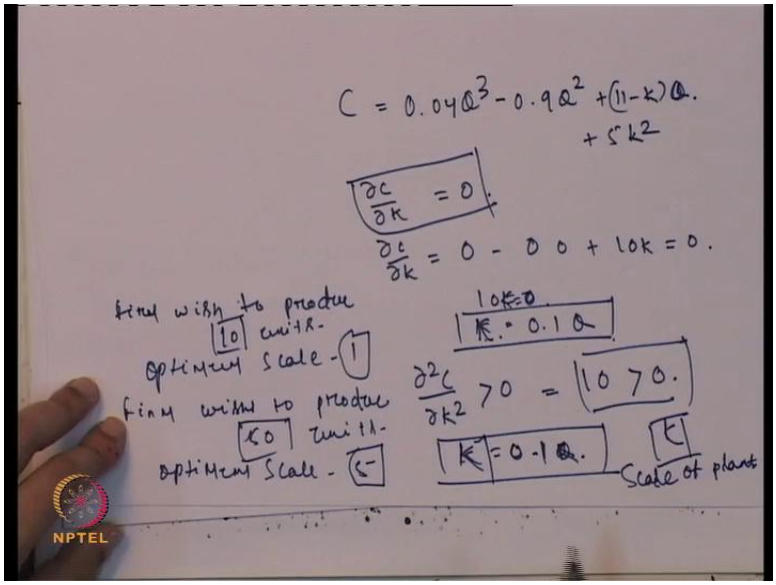

So, let us take a cost function that is C minus C is equal to 0.04 Q cube minus 0.9 Q square plus (11 minus k) Q plus 5 k square, now what is the first order condition, the first order condition is d c by d k has to be equal to 0. So, if you do that, then d c by d k will come to the first term will be 0, the second term will be 0, the third term will be 0, and the fourth term will be 10 k, this is has to be equal to 0, so 10 k is equal so 10 k is equal 10 k is equal to 0 and K is equal to... So, if you look at K is equal to 0.1 Q, so first condition from that we find out that k is equal to 0, and what is our first order condition, first order condition is d c by d k is equal to 0.

Now, we will look at the second order condition, and the second order condition says that d square c by d k square has to be greater than 0, so in this case if you take this, then the first order derivative the second order derivative then we get to equal to 10 which is greater than 0. So, if K is equal to 0.1 Q that is from the first order condition, this is from the second order condition, so we can say that both the conditions are getting fulfilled that is the first order, that is d c by d k has to be 0.

The first order derivative has to be equal to 0, and the second order derivative has to be greater than 0, so in the in this example whatever we are looking at now we are getting (( )) this, condition get fulfilled and we can say that the K is equal to 0.1 Q. And how do

you interpret this if the firm is to produce, if the firm is to produce 10 units, optimum scale is 1, and if the firm is to produce firms is to produce 50 units, the optimum scale has to be has to be 5, because K is 0.1 Q.

And what is K, K is the scale of the plant or size of the plant, so this is how the application of the cost analysis, in case of the optimum level of the scale, identifying the optimum scales. So, if you look at the the cost analysis whether it is average cost, whether it is marginal cost, whether it is total cost, in all these cases generally, it is getting used when the business decision has to be made irrespective of, whether this is related to output, whether this is related to inventory or whether this is related to the scale.

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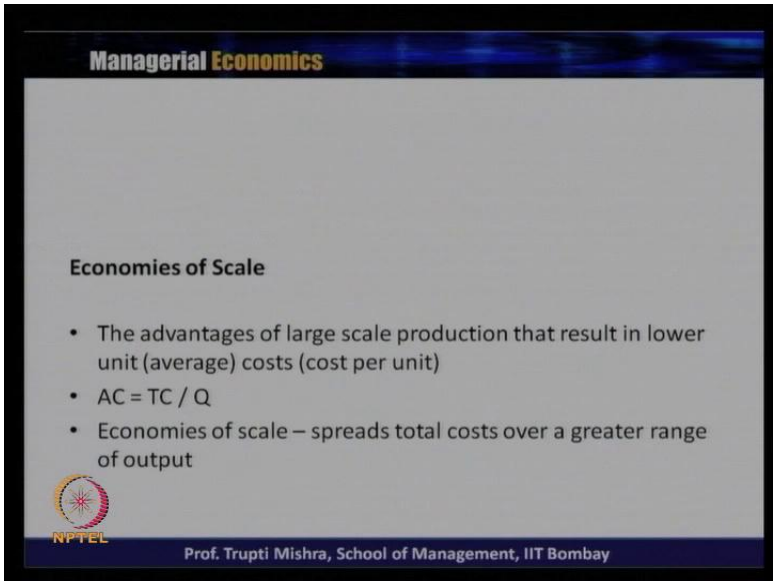

Next, will move to the topic that is economies of scale, and I think we have just the introduced the concept of economies of scale in our previous session, when we are curious enough to know that why the long run average cost curve initially decreases, then reaches the minimum. And beyond that if still the scale of operation of the firm is going on or still the production is going on, then the firm generally, the average cost generally increases. So, let us understand the economies of scale in details, what are the sources, and what are the types of economies of scale, and how generally the firm gets advantage out of it.

So, how do you define the economies of scale, this is the advantage of the large scale production that results in lower unit cost, or you can say that is the advantage of large scale production that results in lower average cost per unit. And mathematically how do you find that the average cost is T C by Q, and economies of scale if you look at it is total cost over a greater range of output, because whatever the total cost that is initially decreasing, then it reaches minimum and increases.

That means that the total cost is not at any point of time generally it spreads over the greater range of output. And that is why we experience decreasing cost we experience constant, average cost and also we experience the increasing average cost.

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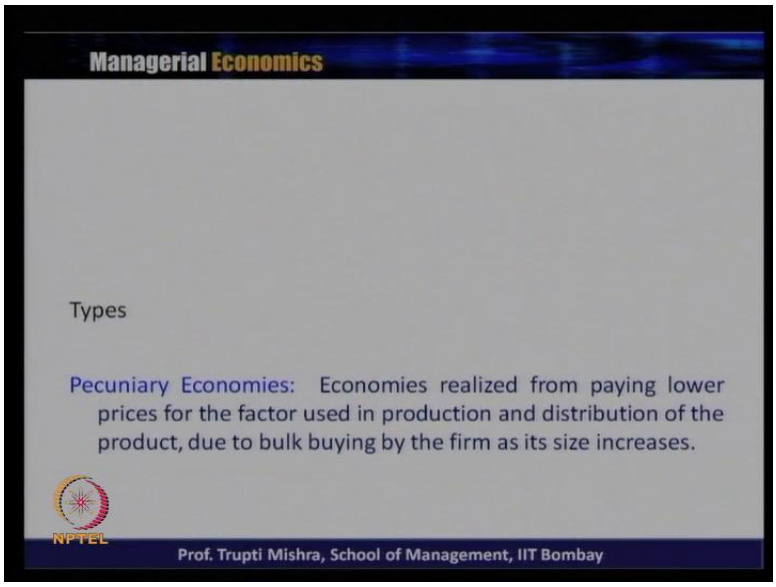

There are two types of economies of scale, one is pecuniary, and this type of economy generally realize from paying lower prices for the factor used in production, and distribution of the product due to bulk buying by the firm as size increases. So, here it is about paying a lower input price, whenever we pay a lower input price, we generally experience the pecuniary economies of scale or we get advantage, in term of pecuniary economies of scale.

So, when the price is being paid less for the input using the inputs, we generally experience the pecuniary economies of scale; that we discuss in a later point of time after we discuss about the real economies of scale. But for the time being the understanding

for pecuniary economies of scale, is it is not about using less quantity of input rather it is the less price what we pay for the input.

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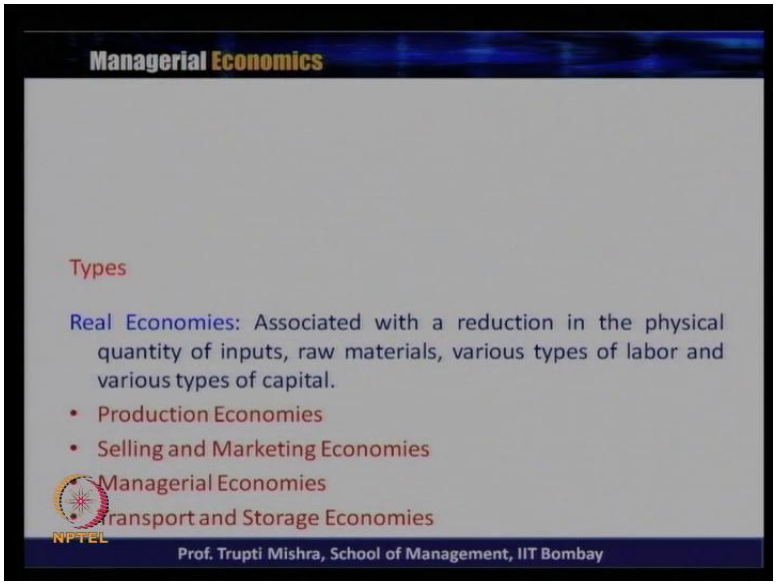

Then the second time is second type is economies of scale is real economy, so real economy is associated with a reduction in the physical quantity of inputs, raw materials, various types of labor and various types of capital. So, pecuniary economy if you remember what we discussed just now, they are not using less input rather they are paying a lower price for the inputs, when the scale of operations increases, and that is how they are getting the advantages or that is how they are generating the economies of scale.

However, in case of real economies it is the reduction in the physical quantity of inputs, raw materials, various type of labor and various type of capital. So, there will be reduction in the quantity of input, there will be reduction in the raw materials, there will be reduction in the labor, there will be reduction in the capital; and if this happens when the scale of operation increases, then only you we can say that the firm is enjoying the economies of scale.

So, we will discuss this in detail this real economies, and there are generally four type of or four category of the real type of the real economies or the real economies is divided into four category. One is production economies, second is the selling selling and

marketing economies, third one is the managerial economies, and the fourth one is the transport and storage economies.

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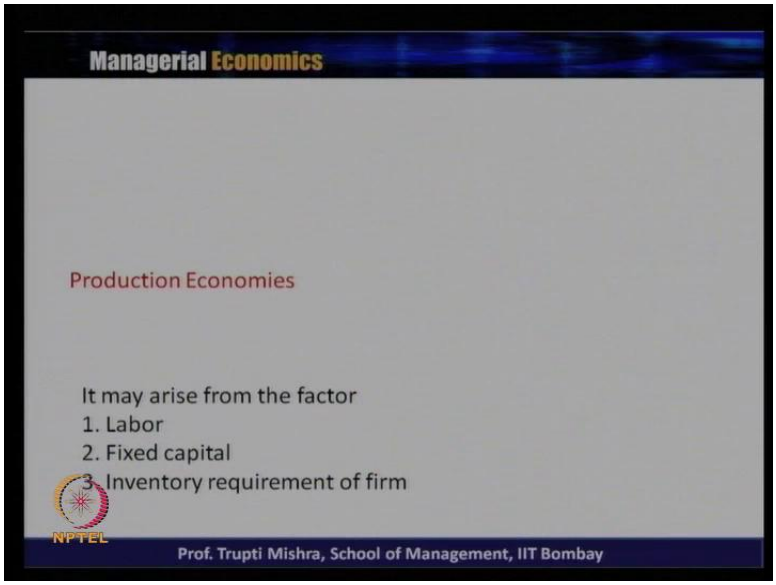

So, (( )) start our discussion with the production economies that is under real economies, how generally there is a production economies of scale, and production economy generally it may arise from the factor that is either from labor, or from the fixed capital, or from the inventory requirement of firm. So, the advantage under production economies of scale, either it comes from labor or from the fixed capital or it comes from the inventory requirement of the firm. Now, when you say that production economies comes specifically from the labor, let us identify the factor, what happens with respect to the labor input that the generally the firm gets the advantage out of it.

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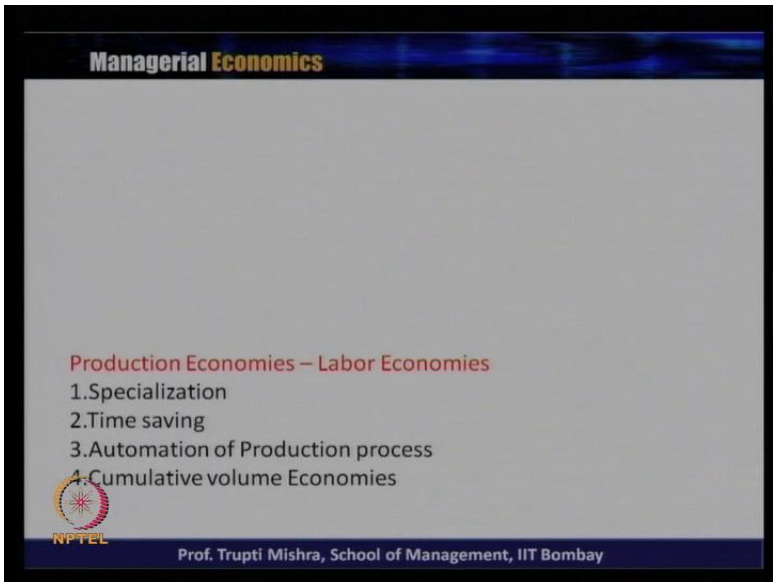

So, when you categorize again in to the labor economy, these are the factor because of what, generally the firm gets some cost advantage or firm, generally may be use less of the labor; in order to produce the same level of output when the scale of operations increases. So, the first factor here is specialization, second is time saving, third one is the automation of production process, and fourth one is the cumulative volume economies.

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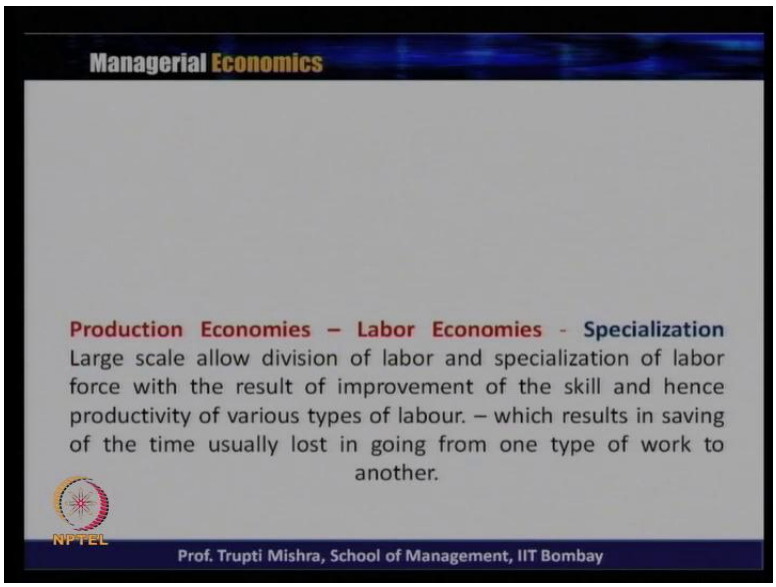

So, will discuss the specialization first and if you look at the sub category, this is part of real economy which again comes under the sub category of production economy, again

comes in the sub category of labor economy, and then it comes to the specialization. So, large scale allow division of labor generally, because the number of labors are more that allows the division of labor, and that leads to the specialization of labor force with the result of improvement of the skill. And hence the productivity of the various type of labor, which results the saving in the time usually lost in going from one type of work to another.

So, if you look at in case of large scale, the pool of labor force is more, so each the pool of labor force is divided into the different group, and they have assigned a specific task; and that is how the division of labor on the basis of their skill, on the basis of their expertise. And in this case what is the advantage, the advantage is that if use the laborer kill is fit into the work, they will do a better work or they will perform in a better way, which result in the improvement of the skill, result in the productivity of the labor. Because they are doing a work which is which is more suitable to them, according to their skill; and that leads to more productivity, and the decrease in the time require to do the work. And that is the reason if you look at, in case of large scale since the division of labor is there that leads to specialization of the work of the labor force and finally, that leads to the efficiency of the, or the productivity of the labor.

And there is less of time and that is bring the cost differential to the firm, and the average cost generally comes down. So, the first factor what we have analyzed is the production economies, in case of labor economies, specialization is the specialization of labor of the division of labor is one, generally where we the firm or the producer in general they get some advantages.

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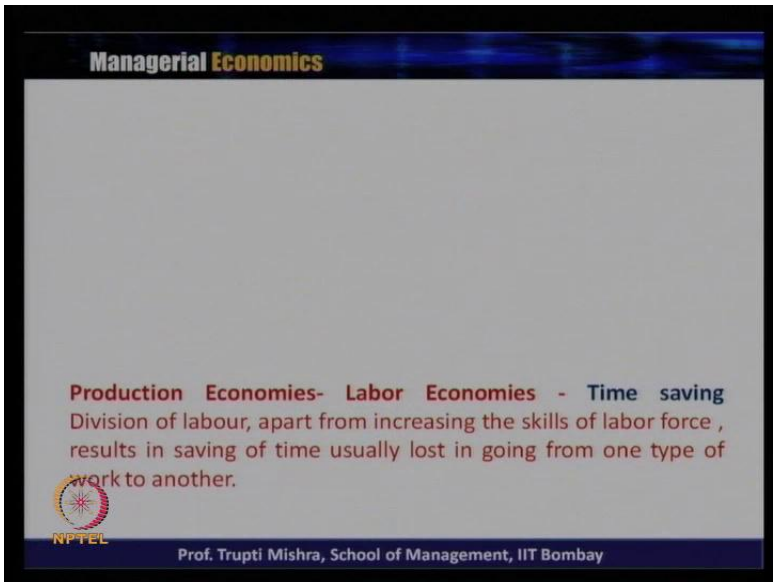

Then we talk about the second factor under labor economies that is time saving. So, division labor apart from increasing the skill of the labor force, results in saving of time usually lost in going from one time to one type of work to another type of work. And the time again brings some productivity, because there is no loss of time the same time is getting utilized for the productivity of the labor. So, if you look at division it is related the division of labor in time saving, in case of small scale firm how it how they do not get a advantage of time saving, because the same group of people either they have to work here or they have to work there.

Because, there is not a different group to specifically work on project 1, project two 2 or project 3, because it is a small operation, but in case of large operation it is possible to divide them, according to their skill, according to their expertise. And in that case they get the advantage in term of productivity, and in term of the time saving which brings the economies of scale to the firm.

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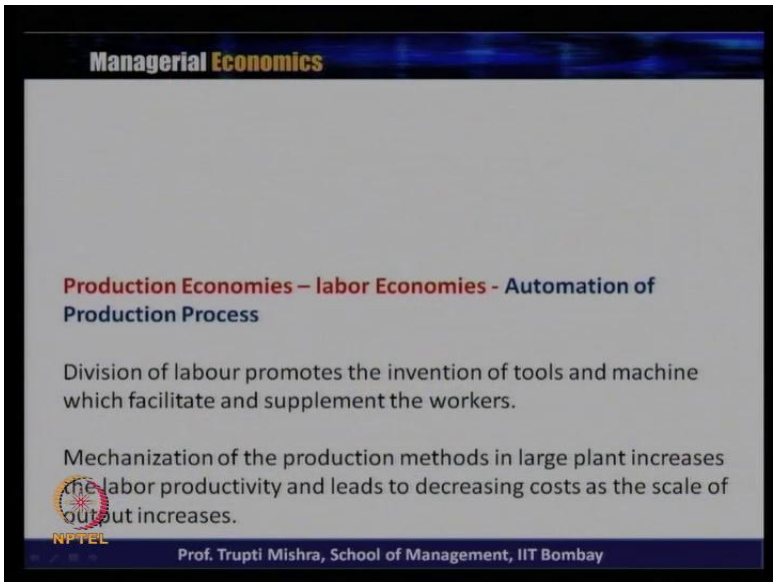

Then we will talk about the automation of production process, how it generates the how it generates the advantage to the firm, so division of labor promotes the invention of tools and machines, which facilitate the supplement supplement the worker. So, if it is they are working a working on a project which fits to their skill, that fit to their expertise, generally that again promotes the invention of tools and machine which facilitate the supplement of worker.

So, mechanization of the production method in large plant increases the labor productivity, a leads to decreasing cost as the scale of output increases. So, whether it is a automation of production process, whether it is mechanization of the process itself that take that reduces the time, that that increases the labor productivity, because they are not doing it manually, and now their production process is become automated. And what is the final outcome, final outcome leads to the decreasing cost as the scale of output increases.

And if there is a decreasing cost that is nothing but the economies of scale what the firm is enjoying. Then in case of production economies of scale in the sub category of labor economies of scale, we have one more one more point or may be one more focal points, where which brings some advantage to the firm, that is cumulative volume economy.

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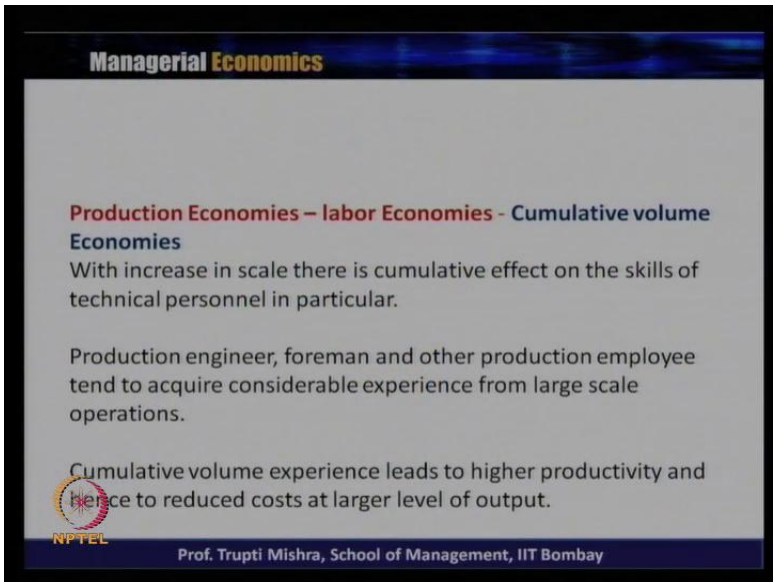

So, with the increase in the scale, there is a cumulative effect on the scale of the technical personnel in particular; so there is a increase in the scale, and which leads to a, which brings a cumulative effect on the scale of technical personnel in particular. So, production engineer, foreman, and other production employee tend to acquire considerable experience from the large scale operation. So, cumulative volume experience leads to higher productivity, and hence to reduce cost at a larger level of output.

Now, what is this cumulative volume economy suppose, you are working on a specific assignment, specific task in a smaller smaller way, when the production operation increases, when the size increases you are contributing to a larger scale. And that again increases the higher productivity, and that again leads to the higher productivity of the labor, and that is the reason if you look at that again leads again leads to decrease in the cost, and improve the efficiency and productivity of the firm. And that is how we can conclude that the cumulative always leads to higher productivity, and hence to reduce cost at a larger level of output.

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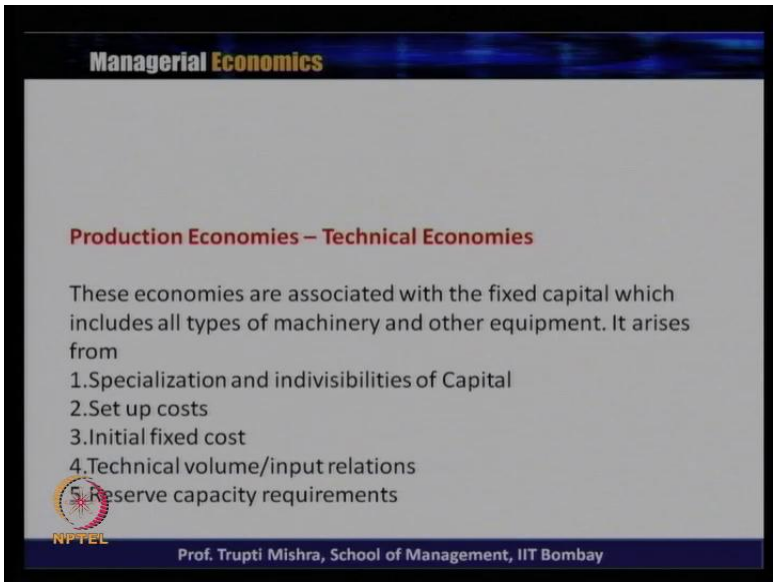

So, then we will come to the second type of production economies that is the technical economy. So, if you remember when we discussed about the production economies of scale, it is started with a fact that production economies of scale, either come from labor or comes from the fixed capital or from the inventory. So, in the first case we discussed about the labor economies of scale, where we discuss about the specialization, where we discuss about the time saving, where we discuss about the automation of production process, and where we discuss about the cumulative volume economy.

Now, will see that there is one more point that is the technically economies, that is the sub category of the producing economy, where the economies are associated with the fixed capital, which includes all type of machinery and other equipment. So, specifically technical is one, where the producer gets the advantage, the cost advantage from the fixed input that is all type of machinery and other equipment or we can call it as fixed capital. So, it arise either from specialization, and indivisibilities of capital or from the setup cost or from the initial fixed cost or technical volume input relationship, or reserve capacity requirement; so these are the factors from which generally with the firm or the producer get the technical economies of scale.

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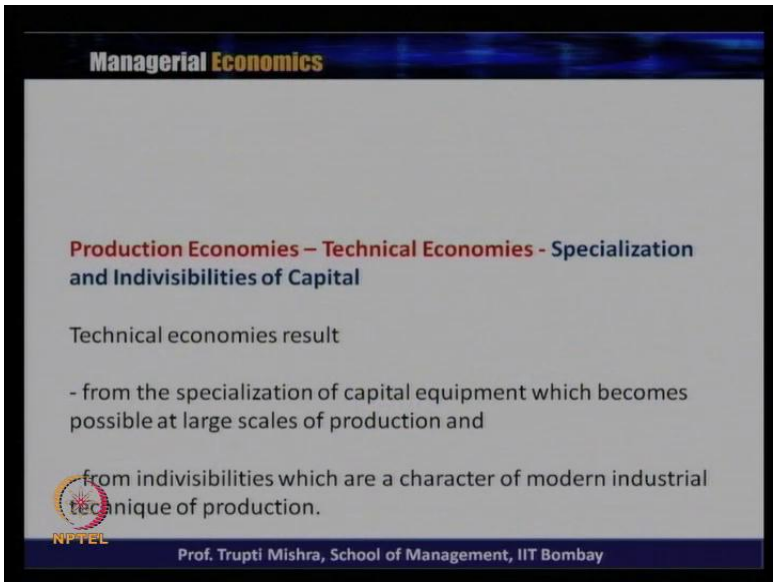

So, let us analyze all these factor one by one, so what is the first factor comes the first factor comes here is the specialization and indivisibilities of capital. So, technical economies result from the specialization of capital equipment which becomes the possible at the large scale of production, and from indivisibilities which are a character of the modern industrial technique of production.

So, one if you look at the machine it is specific, the assignment is specific by the machine, so the it is like the specialization of the labor similarly, the specialization of the capital equipment or machine which becomes possible at the large scale of production not at the small scale of production. And when it is possible at the large scale of production, obviously it leads to the productivity, it is from the technical economies also comes from the individuality which are a character of the modern industrial technique of production. Because if you look at the machine as such a large that, you cannot make them or you cannot divide them for a, in a small small way for the smaller level of output.

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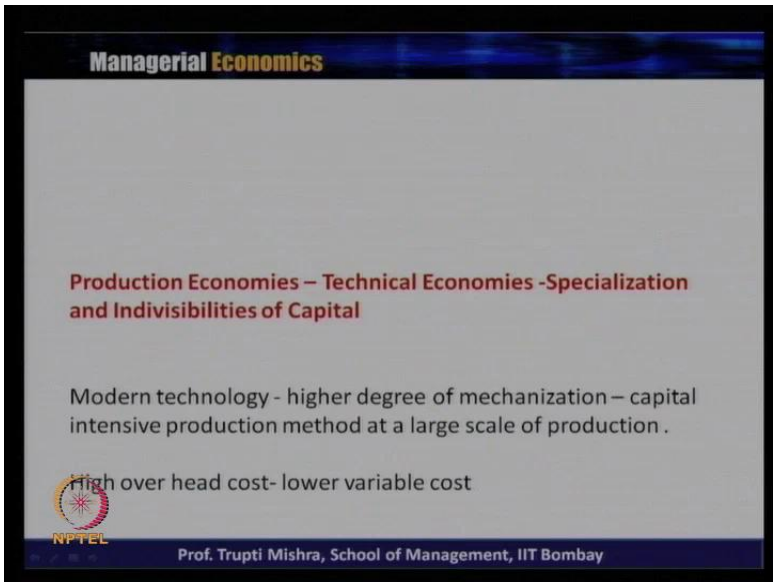

Like typically the assembly line, if you look at fixed for a size, you cannot make it a sub part of it, modern technology is as I said it is a higher degree of mechanization, mainly it is a capital intensive production method, because it is a large scale of production. We talk about the automation of production process, we talk about the high high high end capital equipment, we talk about the mechanization, we talk about the we talk about the high end technology that leads to the, if you look at that is the part of the modern technology. And if you look at these are high overhead cost, but when it comes to the average cost it has to be the lowest average cost, because that is in term of the productivity, and in term of the performance.

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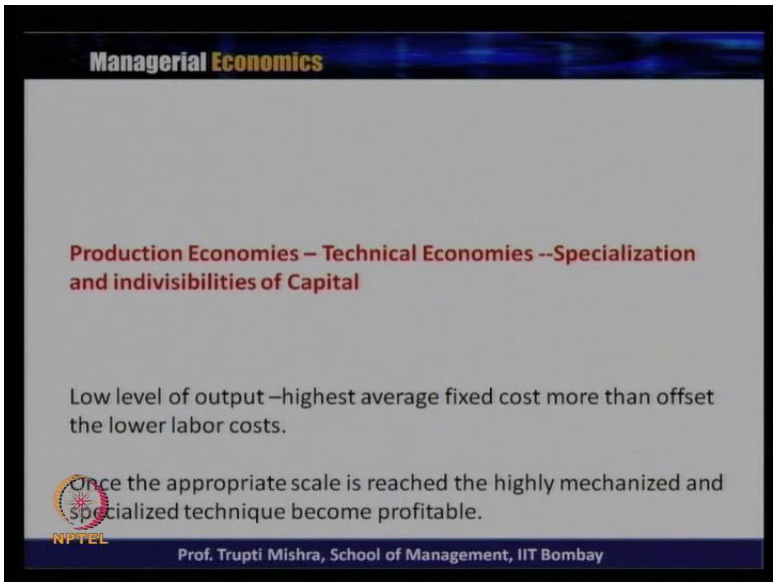

So, when it is the case of low level of output, higher average fixed cost is more than offset the lower level cost. So, initially when such a high end technology, high end machinery, high end may be the automation as a whole or high end about the capital equipment, this is the fixed cost is more specifically at a lower level of output. And the higher average fixed cost more than off set the lower level cost, but once the scale is reached, once there is a large scale, once the scale is reached, and we can call it is a appropriate scale.

The highly mechanizing specialized technique becomes profitable, because why it is profitable because the in the large scale generally the fixed cost gets spread over the larger level of output. And in general the unit cost comes down, which leads to the economies of scale or the cost advantage for the firm, then will take out the second factor that is setup cost how it brings the technical economy.

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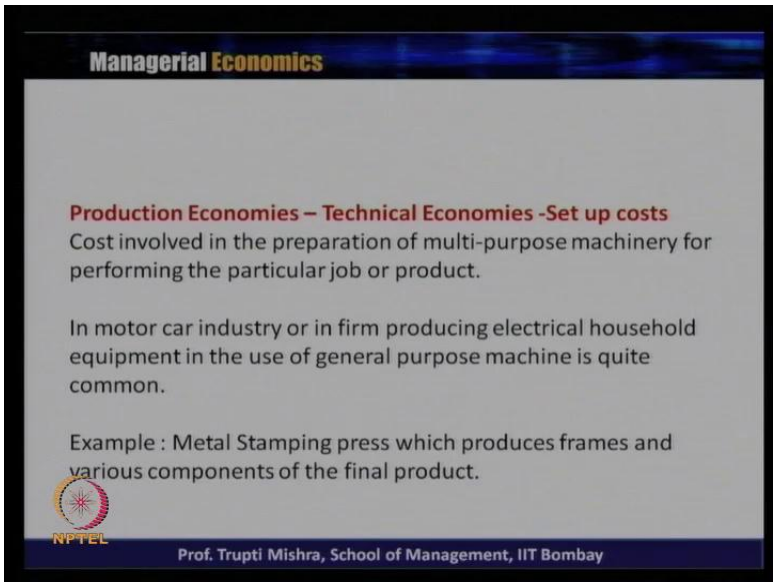

So, cost involve in the preparation of multi-purpose machinery for performing the particular job or product that is generally the set up cost, so cost involve in the preparation of the multi-purpose machinery for performing a particular job or product. And typically if you look at the example of a motor car industry, or a firm producing the electrical household equipment in the use of general purpose machine, is quite common because the set up cost is very high.

So, if you look at, if you again come down to a specific case like a metal stamping press which produces frames, and the various component of the final product. And the metal stamping press has to be reset, any time that a particular car has to be produce, so set up cost is one which is generally requires for the high end equipments.

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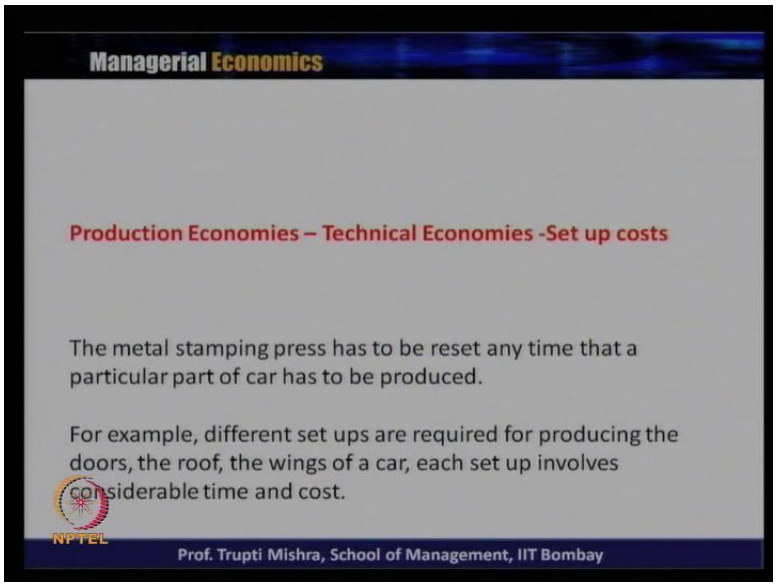

And if you look at the typical example of a metal stamping press, it has to be reset at any time the particular part of car has to be produced. For example, different setup are required for producing the doors, the roof, the wings of a car, and each set up involves a considerable time and cost. So, when it comes to setup cost, if the if it is a case of only one car, then again the average cost or the total cost is on a higher side.

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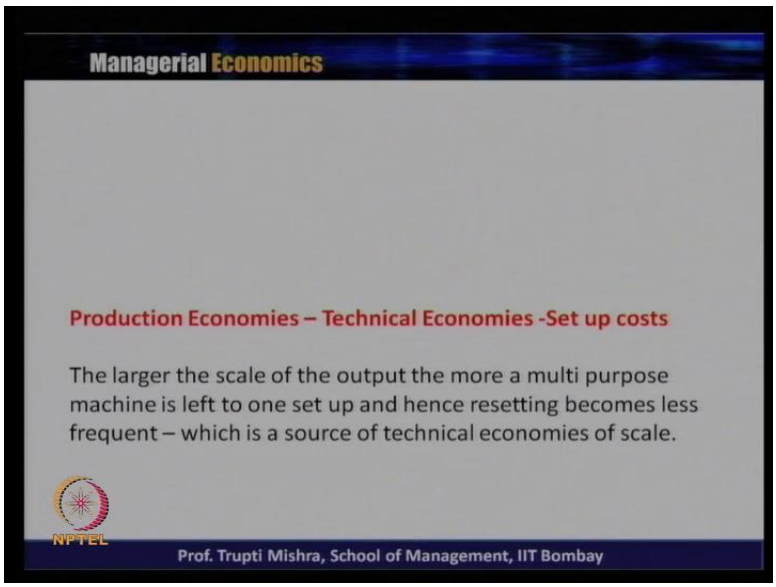

But, if it is case of the large scale output, maybe it is the case of the number of cars the larger the scale of the output, the more a multipurpose machine is left to one set of, and

hence resetting become less frequent which are the source of technical economies of scale. So, the understanding is that, set up cost is required for any the high end cost or the high end capital equipment or high end machine, but even if it requires a set up for the different process, different even intermediate product, and the cost is on a higher side.

But, once the scale of operation increases the larger the scale of the output, the more a multipurpose machine is a left is to is one set of, and has resetting become less frequent. So, one set of all door will get produced, another set of wing will get produced or maybe the another set of the frame will get produced, so if it is large scale in one set up, if the units are more, the average set of cost goes down with each unit of output.

But, if it is a small small plant or the small company, where the unit of output is less in that case generally the set up cost cannot be spread over a larger amount of output. And that is the reason the overhead cost for each unit of output generally on a higher side for a small scale, but larger scale they get a cost advantage, because for one set of they produce a number of unit of output, and which is a source of the technical economies of scale.

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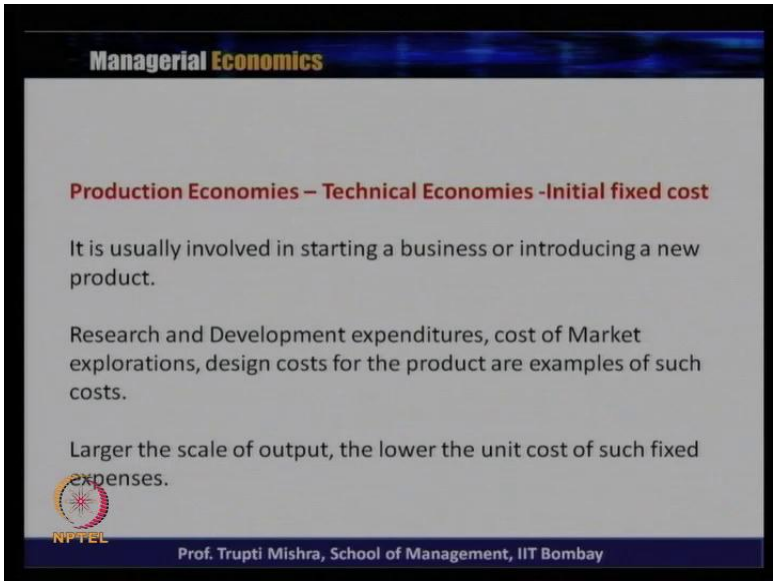

Then we will talk about the next factor that is the initial fixed cost, how initial fixed cost also we can, we also can get a cost advantage from the initial fixed cost of a large scale operation, so it is usually involved in starting of a business or introducing a new product. So, if you look at what is the initial fixed cost, fixed cost when either when you are

starting a business, you need you need a fixed cost, you need a maybe the start up money or startup equipment, or introducing a new product where the where the technicalities are different, you need to get may be new type of capital equipment, you need to get a new set of man power, you need to use a new technology.

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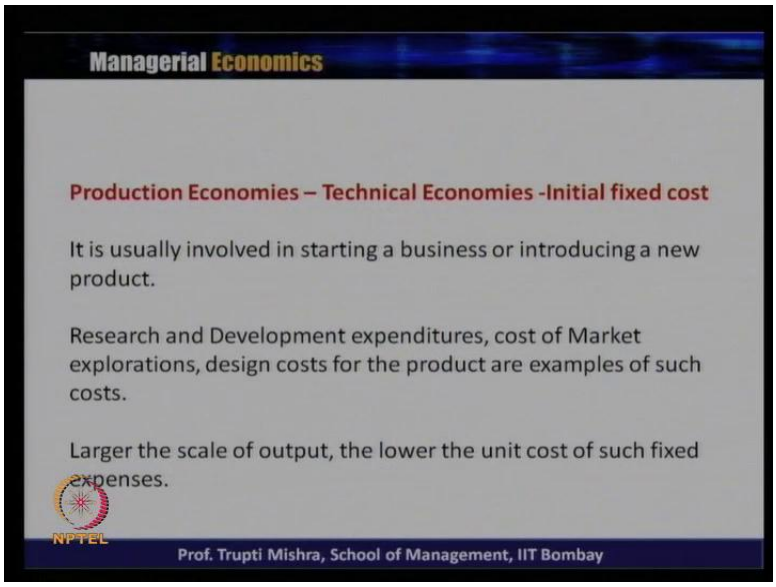

So, research and development expenditure, the so typical example of fixed cost is research and development expenditure, cost of market exploration, design cost of the products is generally it comes under the initial fixed cost. So, these are all how it can be taken in case of a large scale operation, larger the scale of output, the lower the unit cost of such fixed expenses, because it spread over the different unit of output; so larger the scale of the output, lower the unit cost for such fixed expenses.

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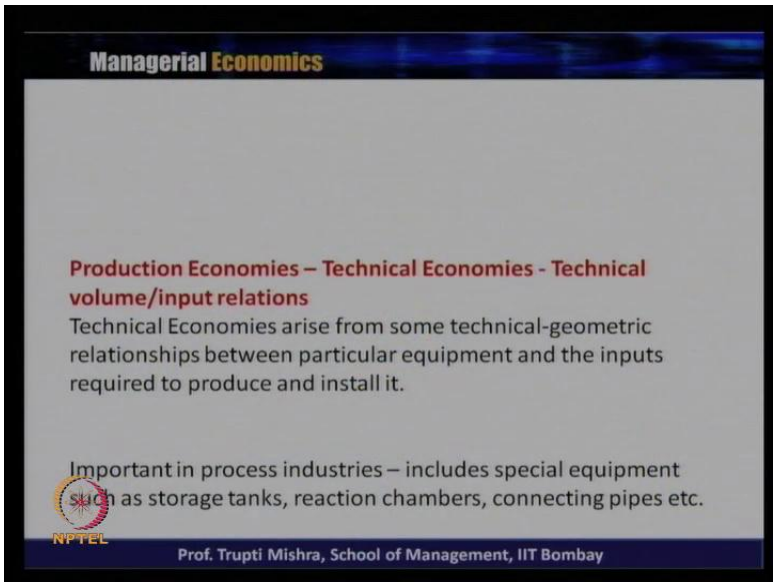

Then we will take out one more factor under technical economies of scale, that is technical volume and input relationship. So, technical economy also arise from some technical geometric relationship, between the particular equipment and the inputs requires to produce and install it. So, there are few important in the process industry like includes special equipments, such as storage tanks, reaction chambers, and connecting pipes.

And in what context we are discussing this, we are discussing this that what is the volume of output and what is the input relationship, whether it is being cost advantage to the firm or not. So, if you look at there are few factors that is important in the process industry, it includes special equipment such as storage tanks, reaction chambers or the connecting pipes; the material and labor cost for each this type of the inputs, you can call it inputs.

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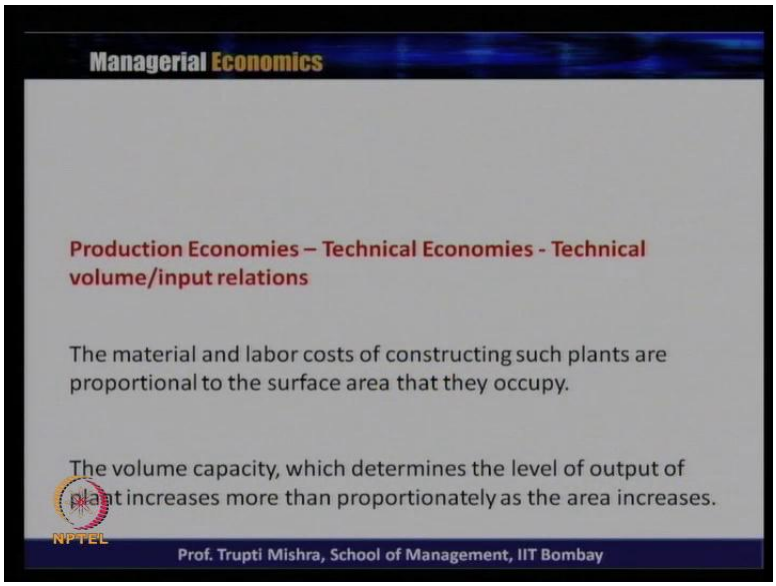

The materials and the labor cost of the constructing such plants are proportional to the surface area they occupy, so it is proportionally the cost is proportional to the surface area, and the volume capacity which determines the level of output of the plant increases, more than proportionately as the area increases. So, material and labor cost they are proportionately related to the surface area of the plant they occupy; and the volume capacity which determines the level of output of the plant, generally increases more than the proportionately as the area increases.

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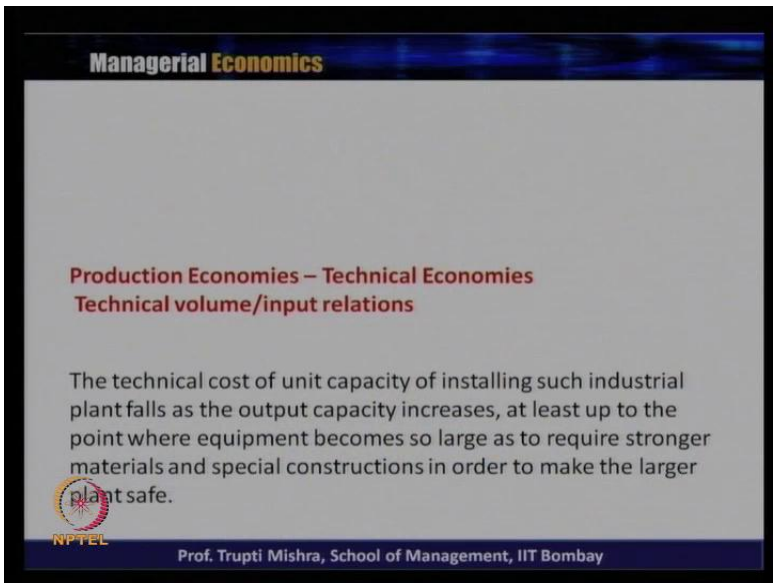

Now, the technical cost of the unit capacity like, whether you talk about the storage tank whether you talk about any other reaction chamber, the technical cost of unit capacity of installing such industrial plant falls as the output capacity increases. At least up to the point where the equipment becomes, so large as to require stronger material and special construction, in order to make the large plant safe. So, the larger the scale maybe the equipment whatever comes, they also requires stronger material and special construction, in order to make the larger plant safe, and there they get their constant advantage, because the scale of operation increases.

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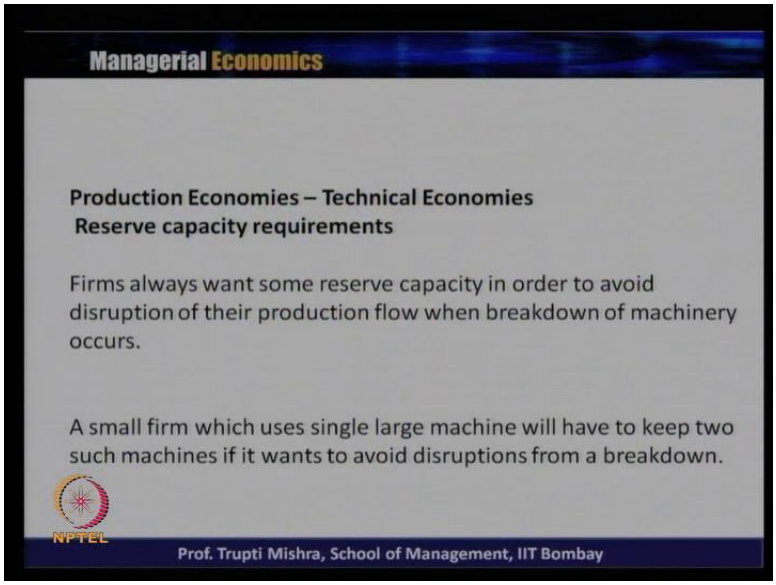

Then the we will come to the last factor under the technical economy, and this is the reserve capacity requirement, so firm always wants some reserve capacity in order to avoid the disruption of their production flow, when break down of machinery occurs. Now, what is the need of this reserve capacity requirement? The reserve capacity is generally is kept, because if in case of machine break down in case of maybe labor force strike, in case of any eventuality, at least the flow of goods and services should go to the market.

And that is how the all the firms keeps some amount of the capacity as reserve, and will see that from the reserve capacity requirement, how the economies of scale is generated. Firms always want some reserve capacity, in order to avoid disruption of their production, when break down of their machinery occurs. So, there may be a possibility

of disruption of their production flow, maybe because of failure of raw material, failure of of technology, failure of machine, where the breakdown of machinery generally occurs.

A small firm which uses the sink in large machine will have to kept keep two such machine if you wants to avoid disruption from the breakdown, because there is only one large machine, which produces the entire requirement of the small firm. Now, for the reserve capacity requirement what we have to do, they have to keep the another large machine as the backup, but in case of but in case of large scale, in case of large scale anyway there are number of machines, so if there is a break down in one, the production flow never stops there, generally it goes, because the other machines or the maybe the other machine they are still producing the product.

So, in this case the reserve capacity requirement is comes from all the machine not from a single machine, so in order to keep the reserve capacity requirement a small firm has to invest more, in order to keep one large machine again as the backup, in case of the breakdown of the machinery. But in case of large firm since, there are number of largeness already in place, if there is no need to keep the reserve capacity requirement, or there is no requirement for the reserve capacity.

Because, if one machine break down the, whatever the production comes from that machine can be, taken from the other machine either by over producing it or may be increasing the quantity whatever there producing. And in this case if you look at, the cost of production decreases, because it is not that unit to do again it is a initial fixed cost, variable cost to run that machine or maybe you are not getting a loss, because there is a decrease in the output, rather that is getting cover in the other machine. And that is why there is, that is another source of technical economies; that comes from the reserve capacity requirement to the real economies of scale.

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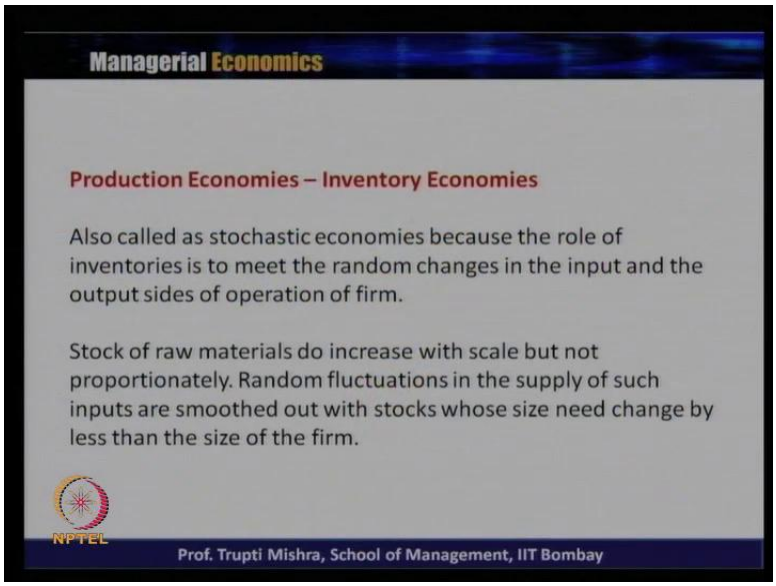

Then we will talk about the third source of production economies of scale, and what is the third source of production of economies of scale, if you remember production economies of scale comes either from labor or from the capital or from the or from the inventory. So, we can call that, now will check that the third one that is the inventory economy, and this inventory economy also called as the stochastic economy, and why it is called as stochastic economy? Because the role of inventory is to meet the random changes in the input, and the output side of the operation of firm; this is called as stochastic economy.

Because, what is the role of inventory? The role of inventory is to meet or the capture the random change in the input and output side of the operations firm, it is not maybe the regular, maybe it is a random kind of thing. So, stock of raw materials do not increase with scale, but not proportionately; stock of raw material increases with scale means, if you are producing 100 units you keep 10 units as the stock of the raw materials, if you produce 1000 units obviously you need to keep some amount which is more than 10 units as the stock of the raw materials, by if your production capacity or if the production level is 1000 units. So, the point here is the stocks of raw materials do increase with the plant size, but not proportionately.

So, ideally what would have been the situation, if 10 units has the stock for 100 units of output, then 100 units would be stock for 1000 units of output, but in reality that does not

happen it increases from more than 10, but it never reach 10, because it is not proportional increase in the with the scale with the scale of the output. So, random fluctuation in the supply of such input are generally smooth out with the stocks, which side need to change less than the size of the firm, and when it is possible this is possible in case of a large scale operation.

So, stock of raw materials increases, but not proportionately, but if there is a random fluctuation in the supply of such inputs, supply of such raw materials that smooth out with stock size need change less than size of the firm. And this is only possible in case of large scale, and that is how we get a economies of scale, or we get the advantage of economies of scale in case of the inventory economy.

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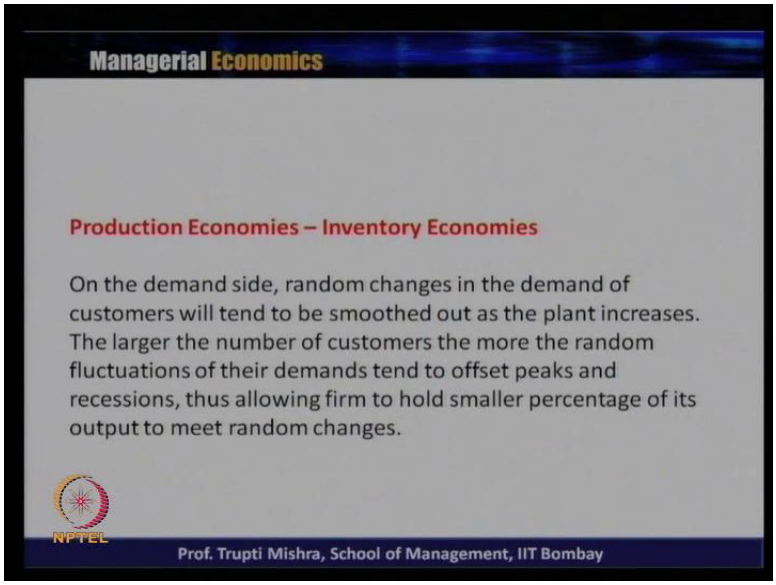

Now, what happens in the demand side, random changes in the demand of customer will tend to be smooth out as the plant increases, so random changes in the supply can be taken from the stock of the raw materials. And on the demand side, random change in the demand of the customer will tend to be smooth out as the plant increases, the larger the number of customer, the more random fluctuation of the demand tends to offset the peaks and recession, thus allowing the firm to hold a smaller percentage of its output to meet the random changes.

So, if you look at when it comes to the demand side, it is not either at the peak or at the low, so when you when you average out the peak and low random fluctuation from the

demand side, ideally firm should not keep the stock on the basis of either peak or the from the (( )). An in this case it generally average out the fluctuation on the higher side, and fluctuation on the lower side; and that leads to or align the firms to hold a smaller percentage of its output to meet the random changes. Because the random changes can go in the positive direction, and also can go in the negative direction.

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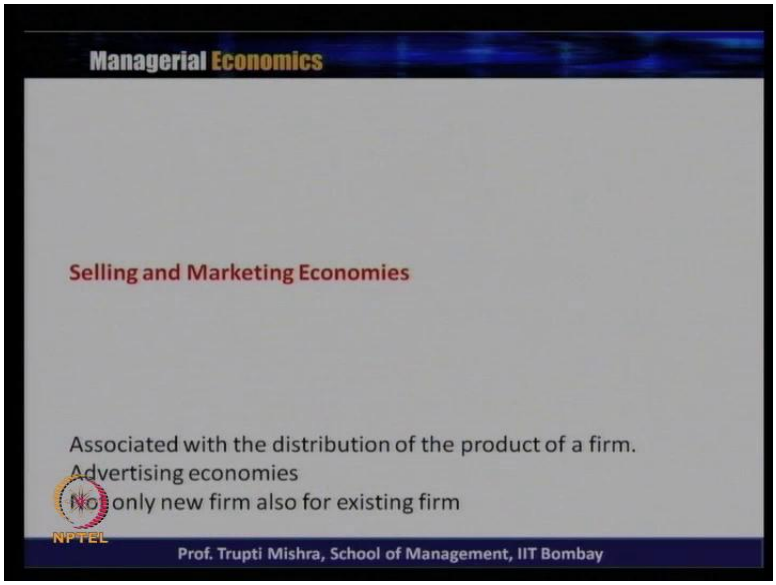

Then we will talk about the second kind of economies of scale, that is selling and marketing economy. So, the under real if you remember that types of economies, one is real economies, second one is the pecuniary economy, and under real economies we talked about the production economies, we talk about the we will talk about the selling and marketing economy. And in case of production economies, we talk about the technical labor economies of scale, technical economies of scale, and inventory economies of scale, because production economies of scale generally come from the labor, capital equipment or the inventory of the firm.

So, in case of second case of the economies of scale under real economies of scale, this is selling and marketing economy; selling and marketing economy generally associated with the distribution of the product of a firm, it comes from the advertising economies of scale not only new firm, also existing firm. So, when talk about advertising, it is not about only for the new firm, but also for the existing firm.

Why advertising advertising is also for the existing firm? Because when the existing firm either they launch a new product or for their existing product to keep fresh in the memory of the consumer, at least to certain point of the certain level of advertisement. So, this advertisement cost is also applicable to the existing firm who are launching a new product, or for the for the existing product, if there is some of the updates or just to keep fresh in the memory of the consumer.

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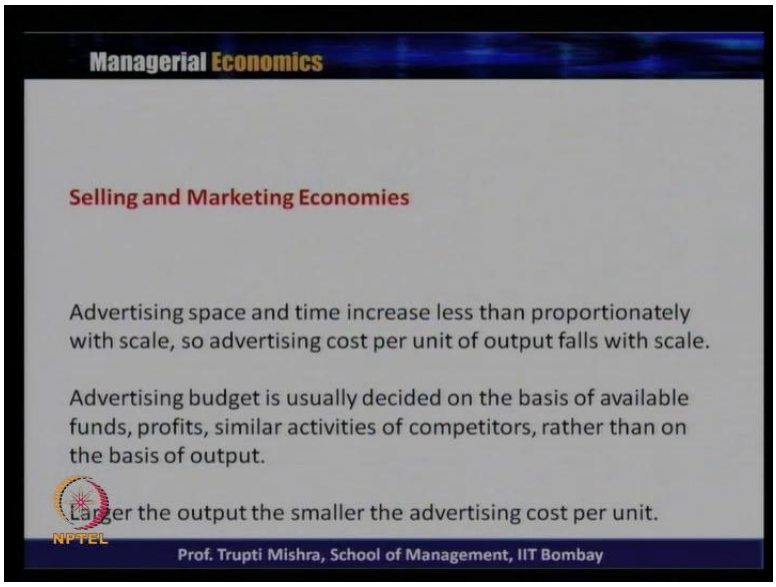

So, advertising space and time increases less than proportionately with scale, so advertising cost per unit of output falls with the scale, and advertising budget is usually decided on the basis of available fund, profit, similar activities of competitor, rather than on the basis of output. So, advertising space and time increase less than proportionately with scale, so that leads to the per unit cost of average advertising cost generally falls with the scale, and larger the output smaller the advertising cost per unit.

Because, whether it is for one product maybe the advertising cost is on a higher side, but when it is more more kind of product it comes from one company, they just one company may be campaigning kind of thing, and that takes care of the product whatever is getting produced by the company. Or the other way, if the advertising cost is for the lower unit of output, even if it gets spread till the average cost is on a higher side, but when it gets spread over a longer spread over a longer or the larger level of output, generally that average cost comes down.

Because, the advertising cost remains same irrespective of whether it is 100 units or whether it is for the 1000 unit. But when it comes to benefit always the economies of scale comes from the 1000 units of output, not from the 100 units of output.

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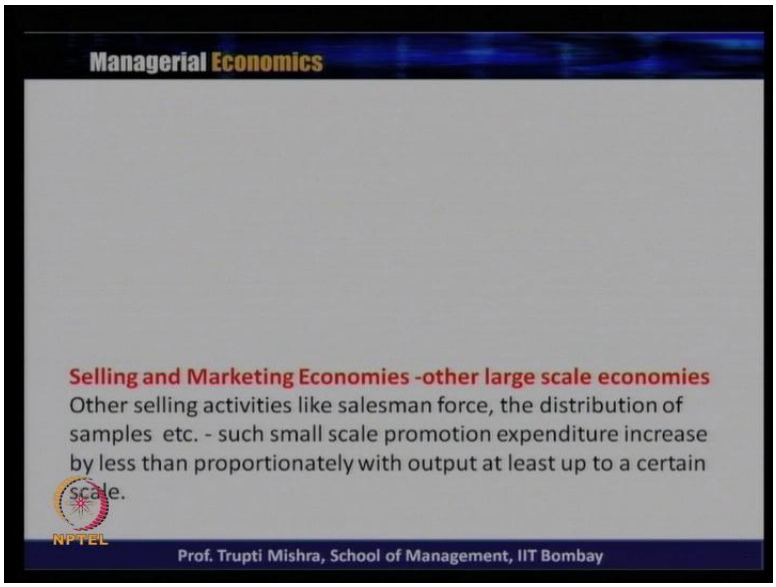

Similarly, if you look at there are some other activity like other selling activity like, salesman force, the distribution of sample etcetera, the such small scale promotion expenditure increases by less than proportionality with output, at least up to a certain scale in case of the large scale output.

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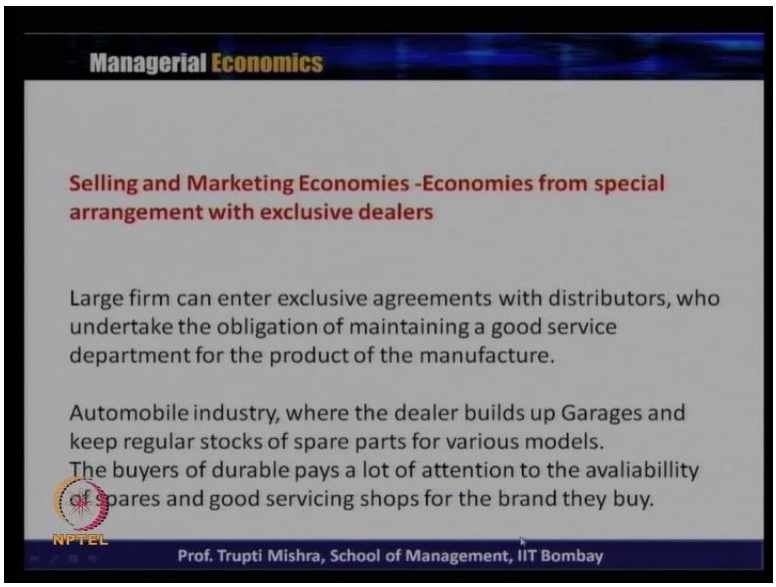

Then there is a third factor that is selling and marketing economy, that is the economics from special arrangement with exclusive dealer. So, large firm can enter the exclusive agreement with distribution, who undertake the obligation of maintaining a good service department, for the product of manufacture. So, automobile industry where the dealer builds up the garages, and they keep regular stock of the spare parts of various models, the buyers of durable pays lots of attention to the availability of spares and good servicing shop for the brand they buy.

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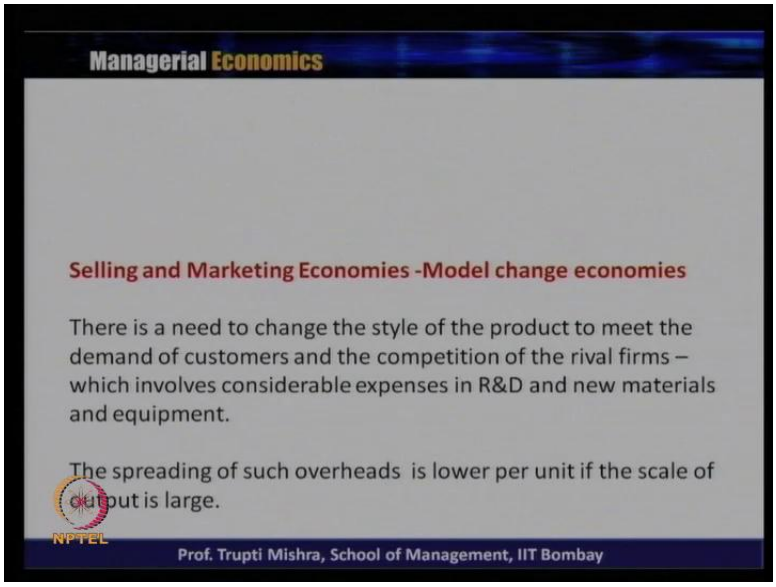

So, if you look at in case of exclusive arrangement with dealer, that leads to some reduction in the cost of production, because the dealer is taking care of the some what has to be taken care of the by the firm itself. Then we talk about one more factor, that is model changing economy. And if you look at there is a need to change the style of the product to meet the demand of customer, which is ever increasing and the completion competition with the rival firms, which involves considerable expense of R and D.

And then new materials and equipment we need to change the model unit to change the style. The spreading of such over head load per unit, if the scale of output is larger, even if the initial fixed cost is high, even if the capital equipment, even if the raw material, even if the labor required is high. But the cost gets spread for a large unit of output and that brings some economies of scale to the some economies of scale to the firm.

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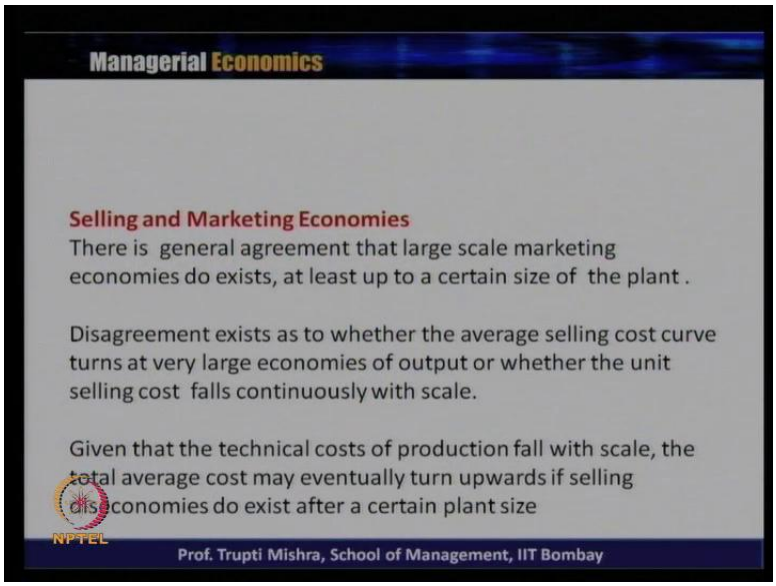

If you look at there is a general agreement that large scale marketing in case of generally the large scale marketing economy do exist, but at least up to a certain size of land. But there is some amount of disagreement exist as to whether the average selling cost curve turns at very large economies of output or whether the units selling cost will continuously with scale. So, given the technical cost of production falls with the scale the total average cost may eventually turn upward, if it is a selling economy do exist after a certain plant size.

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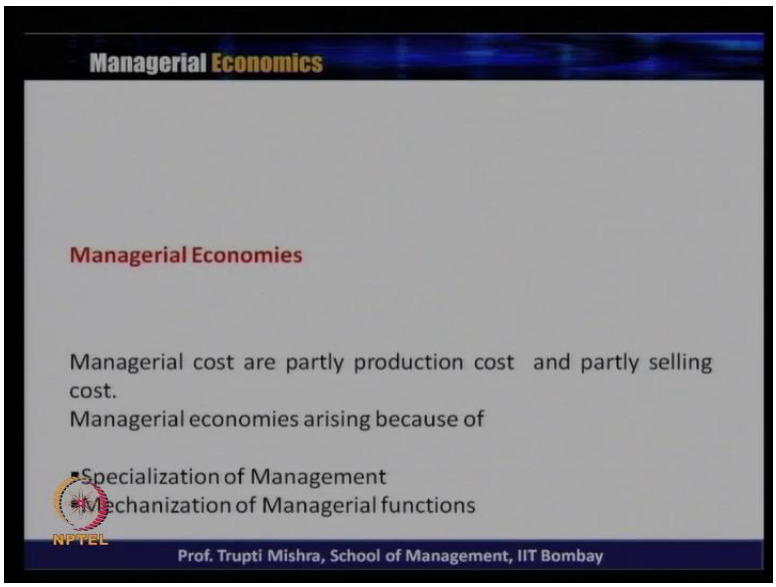

So, we will stop here today and we will discuss in the next session about two more type of economies of scale, that is managerial economies of scale and transport and storage economies of scale. Then we will spend some time on the pecuniary economies of scale and we will check that whether diseconomies exist at any point of time for a specific plant. And if it exist and if diseconomies exist maybe what are the factors or what is the reason behind this. Then we can continue our discussion in the next session the whatever the part left in the economies of scale.