Management of Inventory Systems
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Lecture- 60
Logistics and Supply Chain Management (Contd.)

So, now we are going to discuss a topic which is ah very very important when we discuss on the supply chain management related issues. and This topic, which I am going to discuss during this lecture session that is the supply chain performance measurement and evaluation methodology.

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In the last the lecture sessions I mention that the for any the supply chain the network, say measurement system has to be implemented and so that the focal company within the supply chain network gets a lot of benefits lot of advantages.

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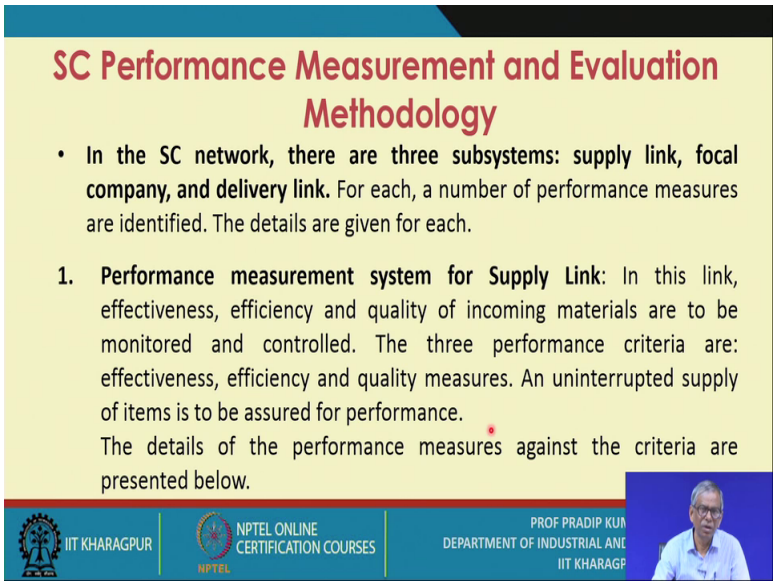

Because in today's context you will find in majority of the cases that the focal company is the performance is significantly affected by you know by many the members of ah then the supply chain network. Either you know this effect the effect on the performance both operational as well as the financial performance is effect could be direct or the effect could be indirect.

So, what is important is that, when you analyze your operational performance as a focal company or you analyze your financial performance, you need to know that what extent your performance is related either positively or negatively to the performance of the relevant on the supply chain members.

So, for that what you need to do; that means, a comprehensive performance supply chain performance on evaluation methodology you need to use, because whenever you refer to the supply chain network, it is a very complex entity and there are many factors on the interrelated, there are there are the dependency between all these factors. So, so you have to be very careful and in the in modeling this entire network.

So, that you must not miss any relevant the parameters in your modeling approach. So, here what you are trying to do, you are trying to so the discuss a comprehensive methodology or supply chain performance measurement and evaluation.

Now let me just tell you some important aspects. In the SC network there are 3 subsystems already it is known, we have explain the supply chain network from the different perspectives. So, there are 3 specific sub systems you need to consider the first one is a supply link, then you have the focal company this and then you have the delivery link. For each of these subsystems a number of performance measures are to be identified the details are given for each.

So, when you refer to the performance measurement systems or the supply link, 3 important you know the dimensions of performance ok; you need to consider 1 is effectiveness, second one is efficiency and the third one is the quality. As you may be knowing that the performance is a multidimensional concept and usually there are there are 7 dimensions of performance, like say efficiency, effectiveness, the quality, quality of work life, innovation, productivity and profitability. So, these are the 7 dimensions and what you have to first you have to the select the appropriate dimensions against a particular subsystem.

So, here for the supply link you need to select the 3 specific performance related dimensions, effectiveness, efficiency and quality of incoming materials are to be monitored and control. The 3 performance criteria are effectiveness efficiency and quality measures and uninterrupted supply of items is to be assured for performance, what we have been pointing out that is a continuous flow of materials that is to be assured and for that many sorts of the techniques you can apply like a DVR scheduling under are the TOC or you can use you know the distribution requirement planning system MRP systems and all those.

So, that or for the JIT based approaches also you need to adopt. So, all these details we have discussed in our previous lecture sessions. The details of the performance measures against the criteria are presented below.

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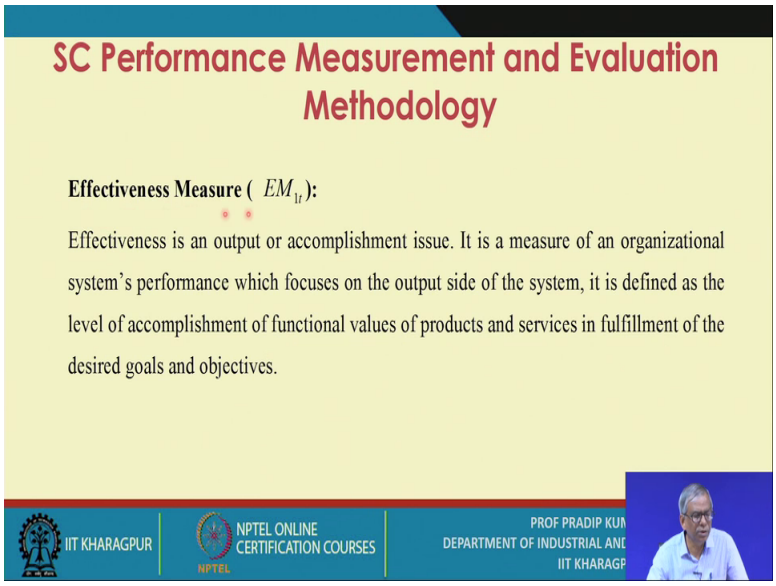

So, what are these like the effectiveness measures? So, how do you what is effectiveness? Effectiveness is an output or accomplishment issue is a measure of an organizational systems performance, which focuses on the output side of the system, it is defined as the level of accomplishment of functional values of products and services in fulfillment of the desired goals and objective.

So, this is this is the definition of effectiveness and then what you try to do? That means, for effectiveness measures that are identified for supplier link, what are those? Likes that supplier delivery performance supplier pricing this is the second factor and the third one is inventory days of supply of a particular plant.

So, these 3 factors you consider and having equal weightage to each of these factors. So, now this is this is the way you calculate the effectiveness measures.

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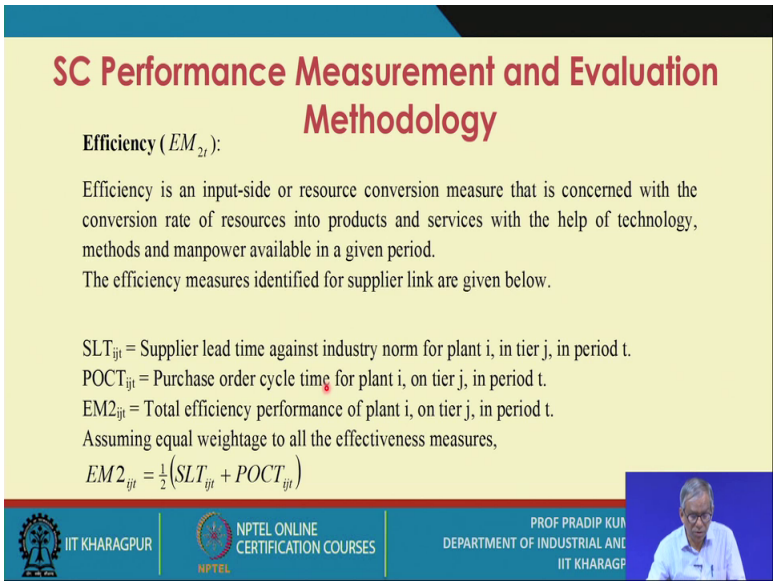

Similarly, for the efficiency you have 2 specific are the measures you consider and once you the considered this 2 like the supplier lead time and the second one is a purchase order cycle time. So, these are the two factors you consider, you just the all the details are given. So, you please go through all these details.

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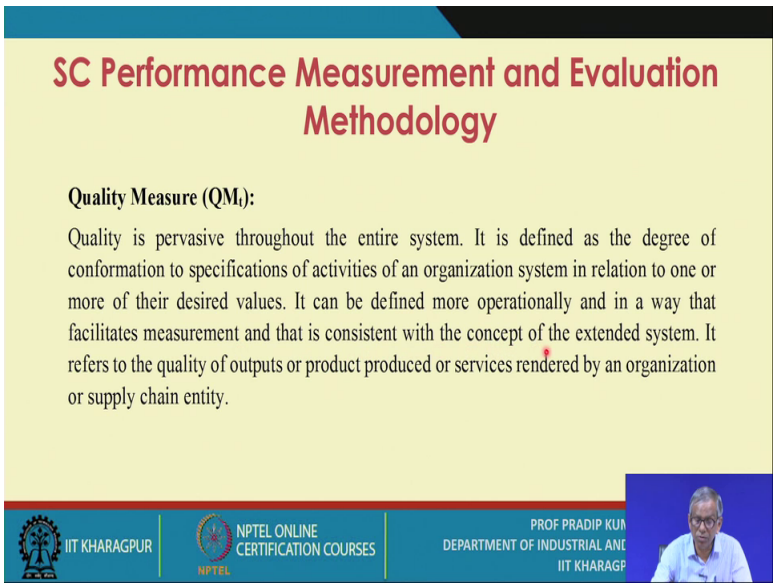

So, this is essentially with we have selected 2 important performance measures against efficiency and for quality measure. So, how do you define quality in this context? Quality is pervasive throughout the entire systems. It is defined as the degree of

conformance to specifications of activities of an organization system in relation to one or more of the desired values, it can be defined more operationally and in a way that facilitates measurement and that is consistent with the concept of the extended system. It refers to the quality of output or products produced or services rendered by an organization or supply chain entity.

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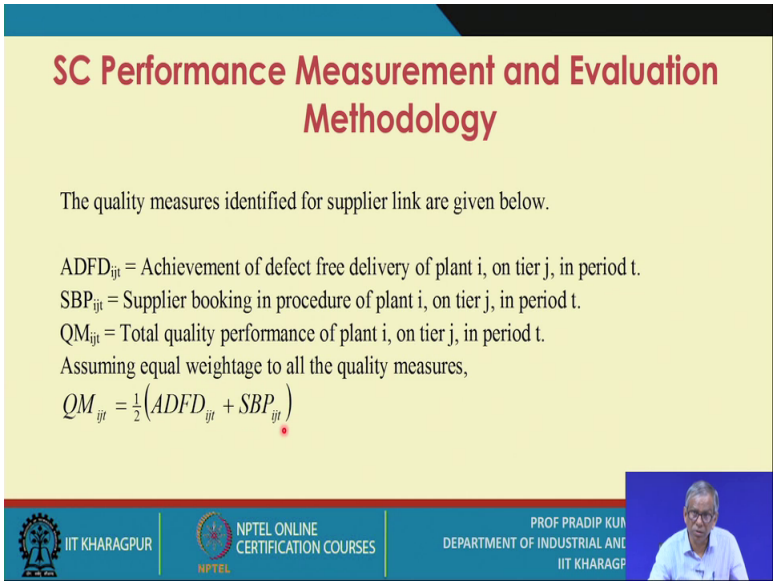

So, how do you measure there are 3 important measures you considers for measuring the quality? First one is achievement of defect free delivery, so that is one and the second one is the supplier booking in procedure of plant i on tier j in period t. So, these are the two factors you consider and you consider these two factors there values to measure the quality.

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Then so the 3 important say the performance measures you considered for the supply link. Or the focal company the performance measurement systems when you talk about. Now, what we are assuming that it is connected with the number of upstream and downstream members is a it is a dynamic systems obviously. So, the five specific performance criteria what are those criteria? Effectiveness, efficiency quality and productivity and profitability, so two more the criteria we have added.

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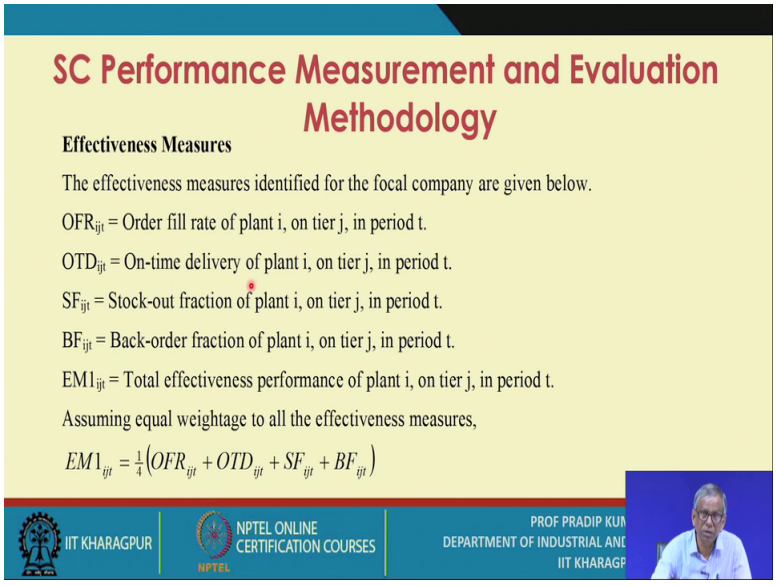

And then the details you can work out; that means, as per as focal say as per as the focal company is concerned, it is effectiveness can be say the measured are considering four specific performance measures.

So, this is the first performance measures that is order fill rate, the second performance measure is on time delivery, the third one is the stock out fraction and the fourth one is the backorder fraction. So, these 4 factors you consider the performance measures you consider I have 2 measure are the effectiveness.

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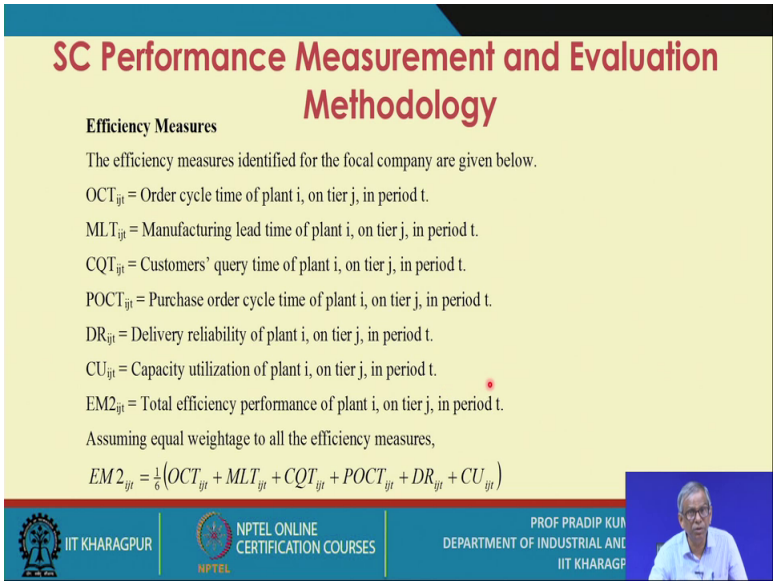

Similarly, when we measure the efficiency for the focal company, you need to consider the 4 specific performance measures. So, all these 4 specific performance measures we have listed like order cycle time, manufacturing lead time, customers query time,, then purchase order cycle time delivery reliability and then the capacity utilization. So, these are the 6 performance measures you need to consider and what we are assuming there of equal weightage.

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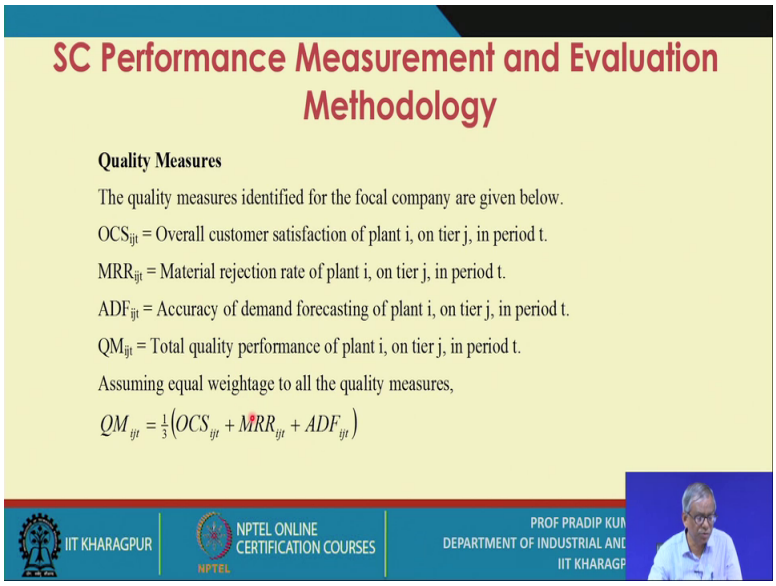

Similarly, when you try to measure the quality you need to consider 3 performance measures, so all these details are here so please you look into all these measures and so, so measuring the quality will not be a problem, only what you need to do only one thing you need to do that is you need to have an appropriate data collection system; that means, with respect to each performance the measures that you consider you are need to collect data.

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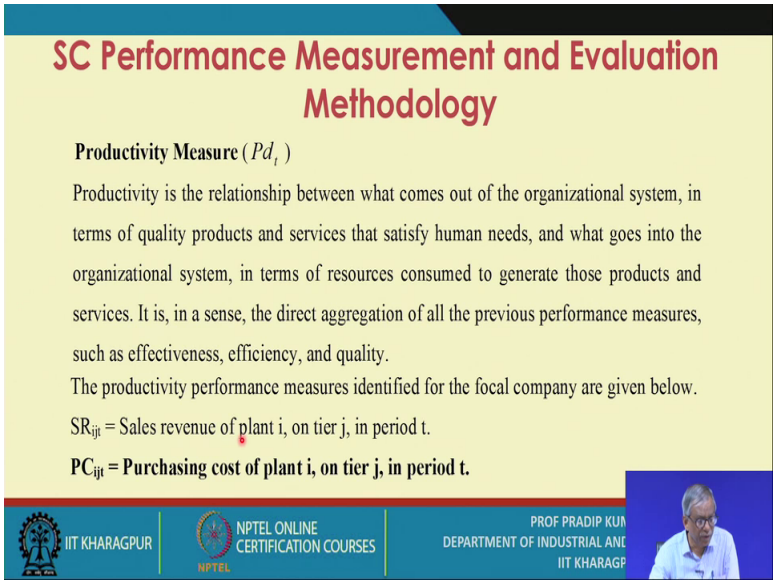

So, now when you talk about the productivity measure ah, so it is essentially the relationship between the output and input and so here you need to consider the sales revenue as a output and the purchasing cost as an impact.

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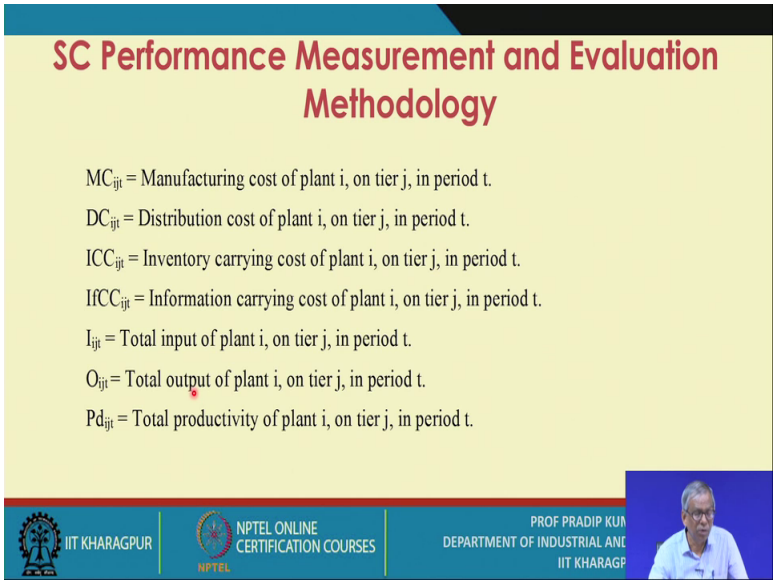

And then the manufacturing cost distribution cost inventory carrying cost then information carrying cost or information storing cost. So, the total inputs you need to calculate and similarly you need to calculate the total output. So, when you consider total output or say total input you get the total productivity.

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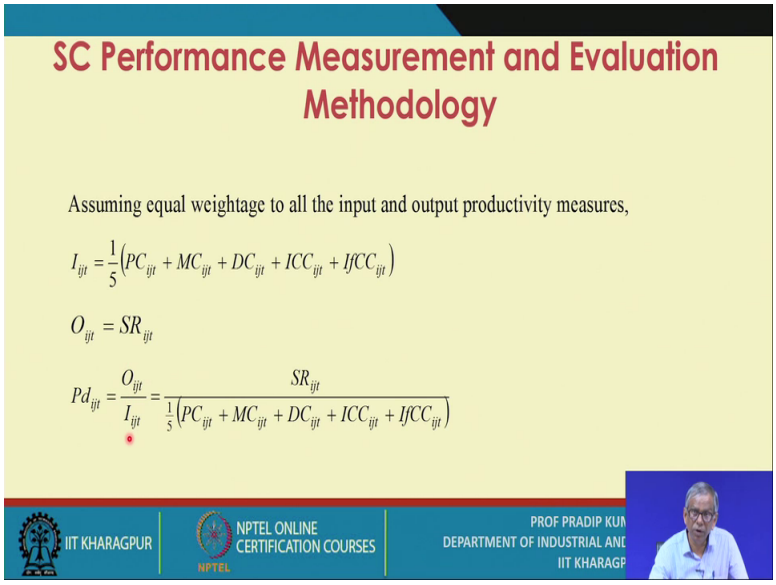

So, this way is so it is in the ratio so obviously, the output divided by the inputs. So, you have the data corresponding to all these measures and you can measure the productivity of the focal company.

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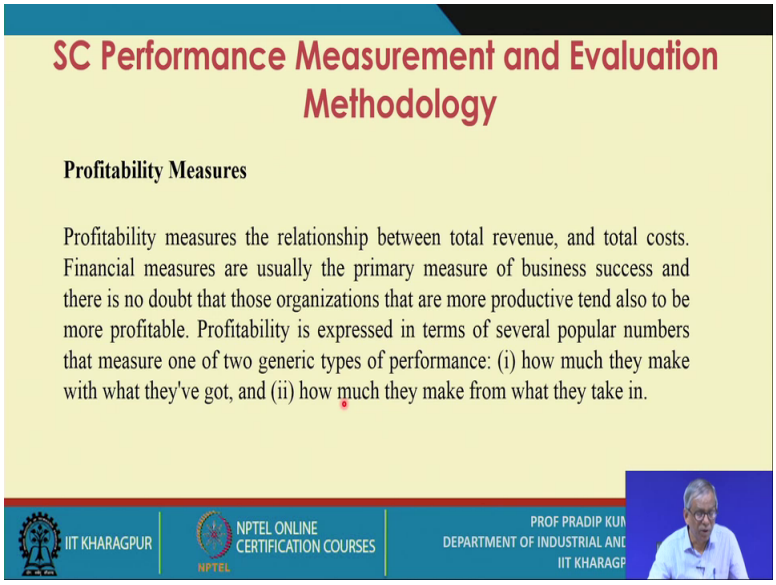

While you try to measure the profitability; that means, are it refers to the relationship between the total revenue and the total costs, so all these details are here.

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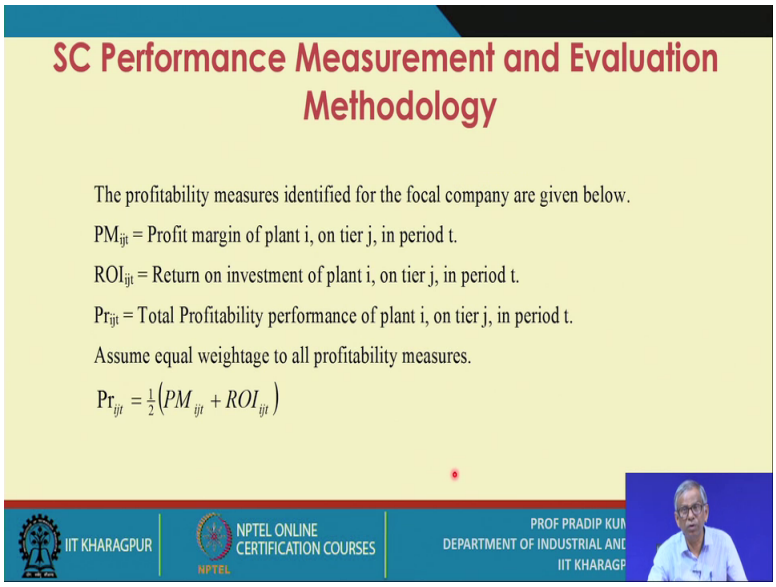

And now for profitability measurement you need to consider 2 performance measures, one is the profit margin of the plant and the second one is return on investment is it. Now

obviously you know one important say the issue is that how many performance measures you need to consider against a particular say you know the performance criteria, like say the effectiveness quality productivity etc.

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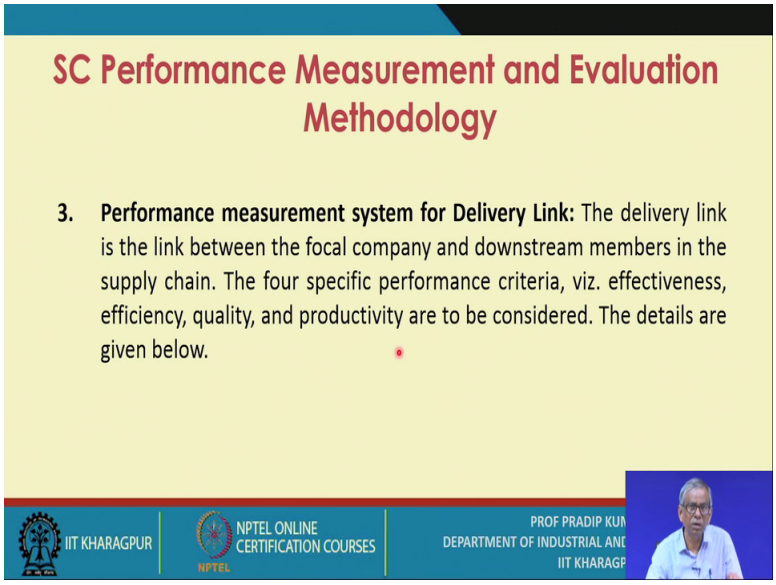

So, here you know you have to justify that why you have been considering certain number of performance measures. So, here in majority of the cases you get the expert opinion or if you have sufficient experience and the knowledge. So obviously, you are the best person to select the appropriate the types and on the number of the performance measures against a particular criterion, so this rule is followed and now we come down to say the third subsystems and which is basically the delivery link.

So, as far as performance measurement system for delivery link is concerned now we need to what is this delivery link; that means, the link this to be defined. So, the link is between the focal company and the downstream members in the supply chain. So, what are the 4 specific performance criteria are you may select effectiveness efficiency quality and productivity ok; we are not say are the measure like profitability may not be relevant in this context.

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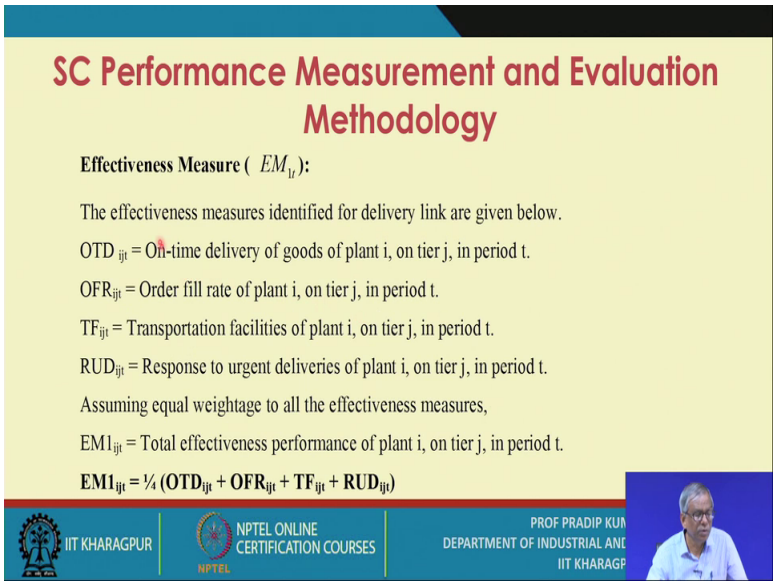

So, again you need to consider the downstream the supply chain and so accordingly you defined the or see you measure the effectiveness, considering 4 performance measures and what are this 4 performance measure on time delivery of goods because, you are essential you are dealing with the outbound logistics systems.

The second important performance measures is order fill rate like it refers to the service level transportation facilities and the response to urgent deliveries. So, these are the four factors, you consider and you measure the effectiveness.

For the efficiency you consider 3 three important of performance measures, delivery lead time, customer query time and the goods receipt, note time receipt, note time, so these are the 3 performance measures you consider for efficiency.

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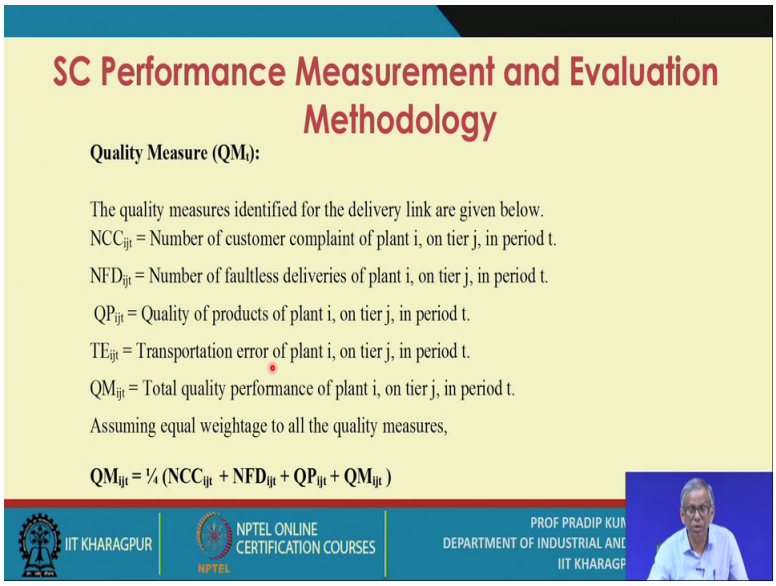

For quality you need to consider the four performance measures number of customer complaints, number of faultless deliveries, quality of products and the transportation error ok, so these are the four factors I need to consider.

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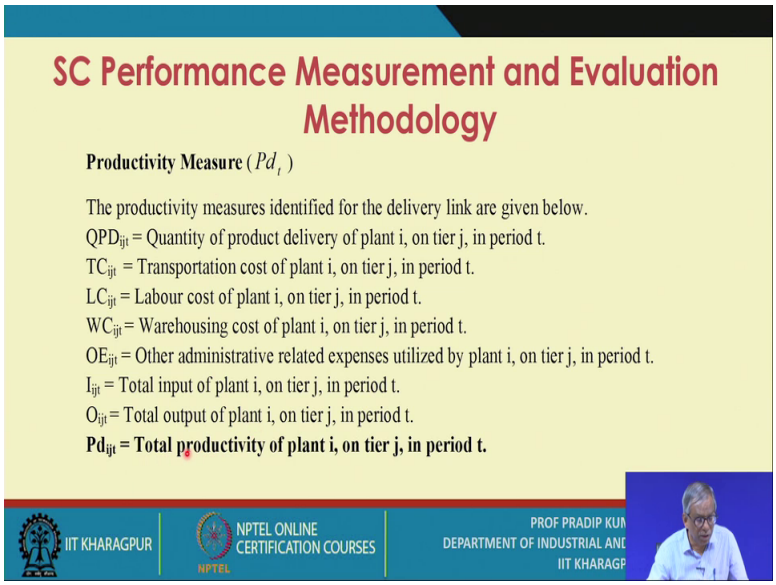

For the productivity again you need to measure the total productivity of plant i on tier j in period t so this why represent.

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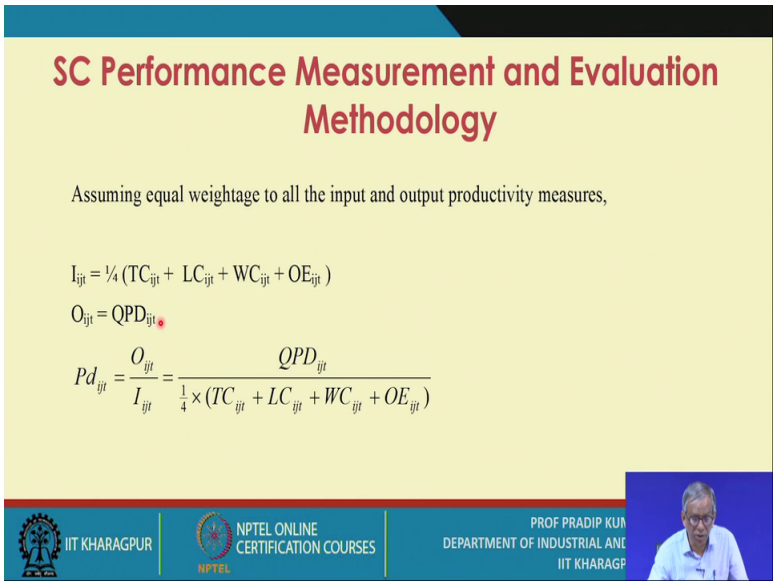

And you need to for the inputs you consider 4 important factors or the measures and for the output, you have you just consider say the one particular measure. So, we have this ratios output by input and you can measure the say the productivity.

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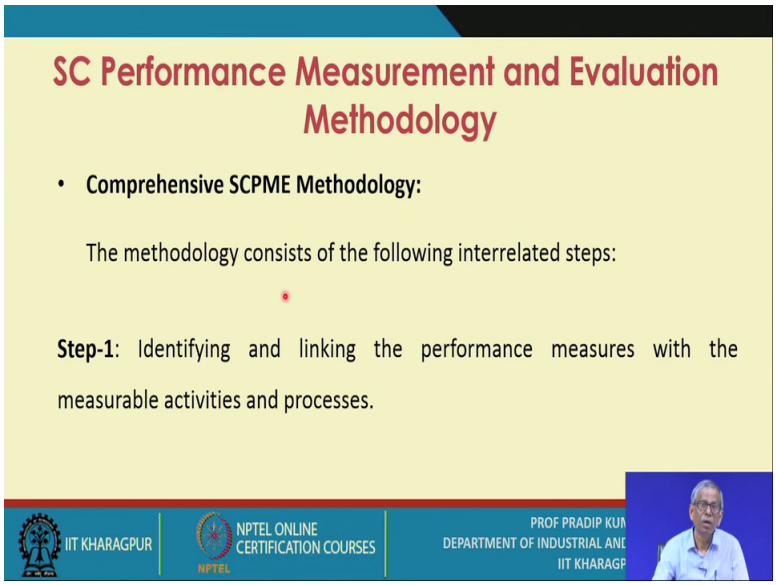

Now, ah you need to apply a comprehensive methodology, now for ah so what are the steps involved in the supply chain a for a comprehensive supply chain performance measurement and evaluation methodology. So, we call it SCPME methodology, so we have considered 3 subsystems, now what you need to do and for each subsystems, we

have identified the performance measures and the prior to that we have identified the relevant are the performance criteria.

So, these details are known so this is so first you look into all these aspects. So, identification of the relevant performance criteria and corresponding performance measures. So, this is the first step. Now when you apply a comprehensive methodology obviously, sometimes you know the network which you proposer which we use for which such a methodology is used, this the network may refer to say a close loop the supply chain close loop supply chain.

So, whether is an open loop supply chain or the close loop supply chain or the subsystem wise are the separate say performance measurement methodology you propose, so those are to be those are to be clearly say the understood and specified.

So, here what you are assuming that all the 3 subsystems are to be considered the simultaneously and that is why we are saying the this is a comprehensive or say total systems approach for measuring and evaluating supply chain performance.

Now this methodology consist of the 6 specific steps in the first step and are obvious reasons there these all the steps are interrelated. In the first step you need to identify and link the performance measures with the measurable activities and the processes. So, that we have already done, so that is that is the first step so here certain comments we have made.

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So, what are these comments the selection of measures; that means, the performance measures is based on the operational performance criteria I have already mentioned, the both operational performance as well as the financial performance both are relevant and here as per as operational performance criteria concerned you need to consider the effectiveness efficiency quality productivity and profitability in the plant, from the view of both suppliers and the customers.

So, there are 5 you know the performance criteria for the focal company we have selected. There are many ways of identifying the performance measures using performance measures questionnaire; that means, you get the opinion of the experts or the knowledgeable persons through questionnaire based the survey, categorizing existing once that you can do and through brainstorming session through NGT session nominal group technique session.

So, the performance measures identified here are based on categorizing existing once in the plant. So, that rule you may follow the other say so the approaches also you can follow. The variables are selected for measurement of plant performance are shown below for the focal company what are those like the effectiveness measures, what do you try to do the achievements code for the variable ratio of actual and planned productions for plant 1 on tier 0 in period t.

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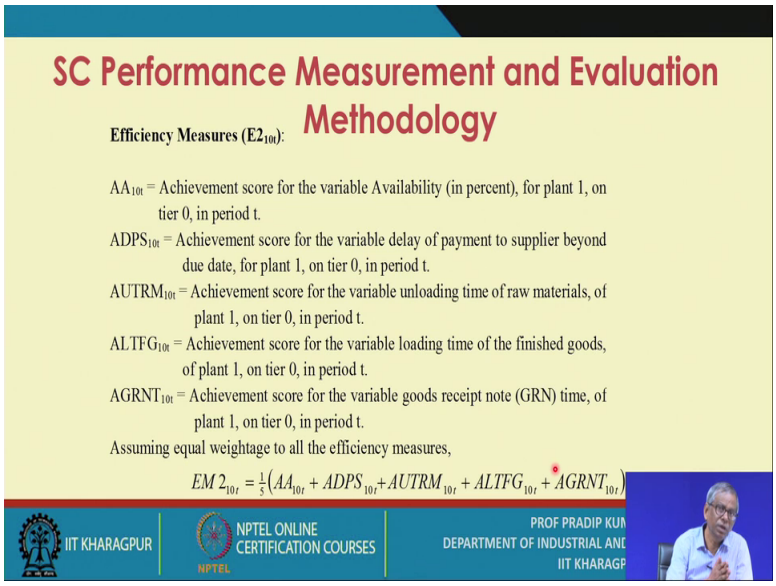

So, this way you specify and so you refer to the achievements scores and these are the achievements scores. So, the 4 performance measures we have considered and against each performance measures we need to have the achievement score and for getting this the achievement score what you need to do that you need to bring in the concept of utility function.

Similarly for the efficiency measures so 1 2 3 4 5, so the 5 specific performance measures, we have considered and against each performance measure you have the utility function and then against that one particular utility functions, you have the achievements score for a particular performance measure. So, you get all these values and you take the average is it.

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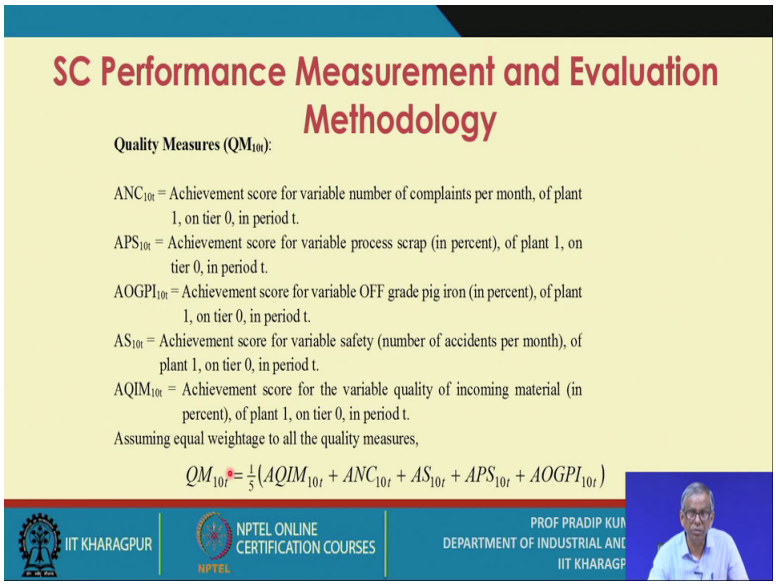

So, this is for say the efficiency similarly the similar approach you follow for the quality measures. So, you just go through all these details, details are given.

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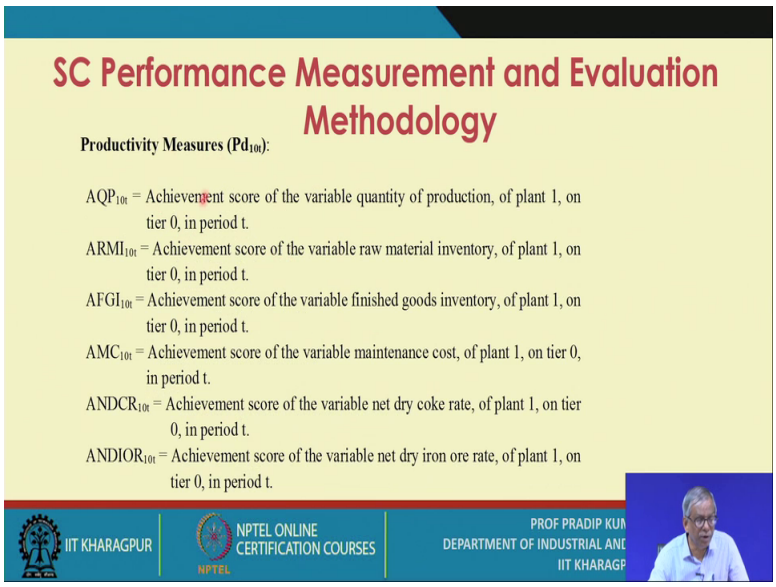

For productivity measures again you consider against a particular performance measures or against a particular say the input related factor or the output related factor, the corresponding achievements score you need to you need to consider and for which ah you refer to the but the utility function.

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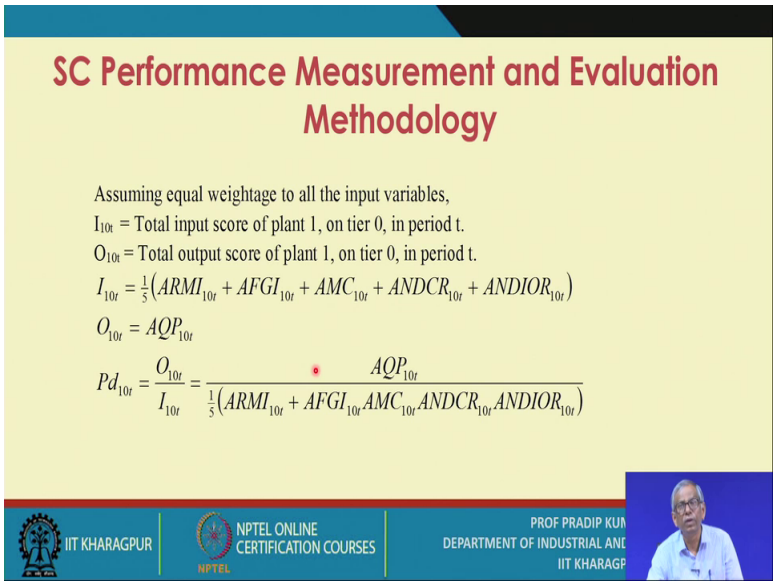

So, all these the details are given over here that means, what you try to do; that means, you try to get the values of a each measure at a particular time period in terms of the achievement scores. And for getting this achievement score what you need to do? That means, you need to have against each performance measure for the utility functions.

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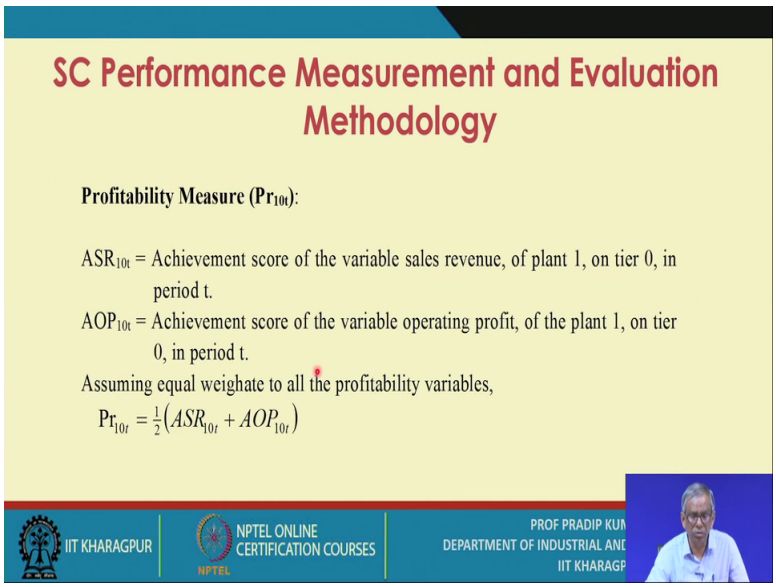

So, all these details go through similarly for the profitability measures you have in terms of the achievements scores, so this is the step 1.

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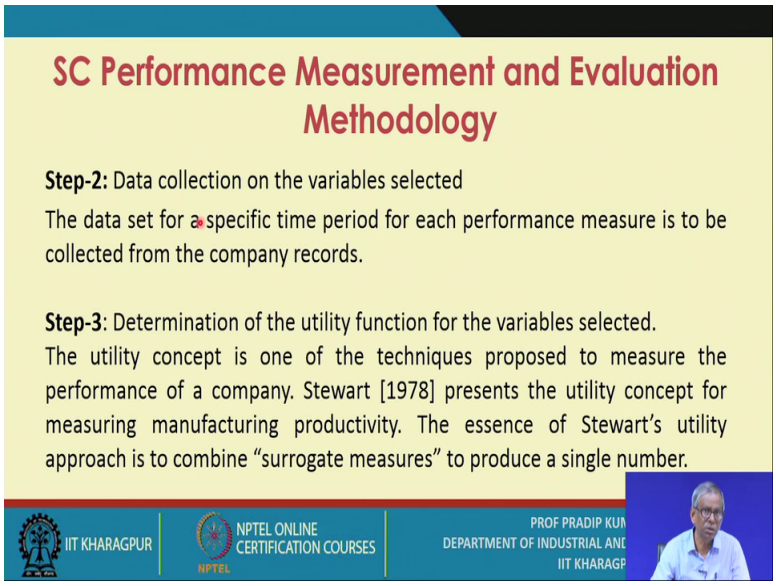

So, you follow this step basically the step 1 of forms the foundation of the methodology. Once the step 1 is over then you go to step 2. So, the step 2 you go for data collection on the variables selected. So, you will come to know what are the variables and against each of these variables you have to collect data; the data set for a specific time period for each performance measure is to be collected from the company records. That means, once you try to apply this methodology you must be say adequately supported by are the company's information system.

So, information system support is a must; then you move to step 3 determination of the utility function for the variable selected I have already mention. The utility concept is one of the techniques proposed to measure the performance of a company. So if you refer to the literature so this is an well established a technique utility functions and particularly in the domain of so the multi criteria are the decision making. So, so this approach you can follow and so it is easy to understand and it is a rational approach.

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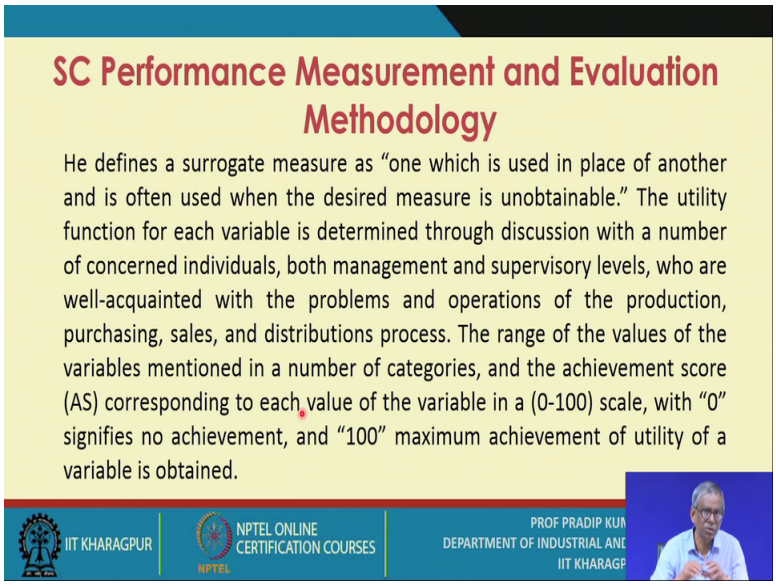

So, and it may be a surrogate measures so the alternative measure, but it is very useful in the sense that if you know start measuring are the performance with these approach, then it becomes easier for you to identify the reasons of but so the causes of higher performance of the lower performance, and it becomes easier for you to identify the collective or the preventive measures for improvement of performance, so all these details are here.

So, here what you try to do? That means, you must have against each the variable you must be able to propose an utility functions. So, so data are to be collected relevant data regarding or with respect to a particular variable you need to collect and then you have to get you have to go for plotting of the utility function.

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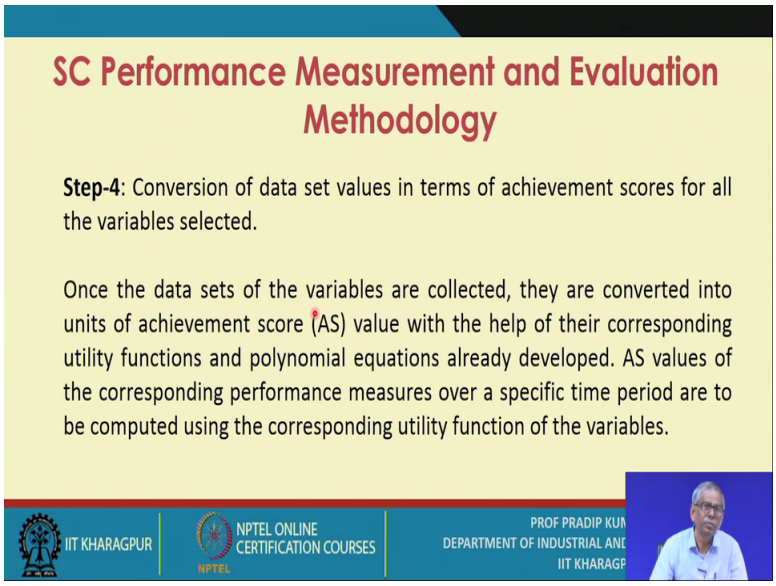

So, so this is so when you complete step 3 then you move to step 4; that means, conversion of data set values in terms of achievement score for all the variables selected. So, this point we have been mentioning. So, once the data sets for the variables are collected, there converted into units of achievements score value, with the help of their corresponding utility functions and polynomial equations already developed. AS values of the corresponding performance measures over a specific time period are to be computed using the corresponding utility fractions of the variables.

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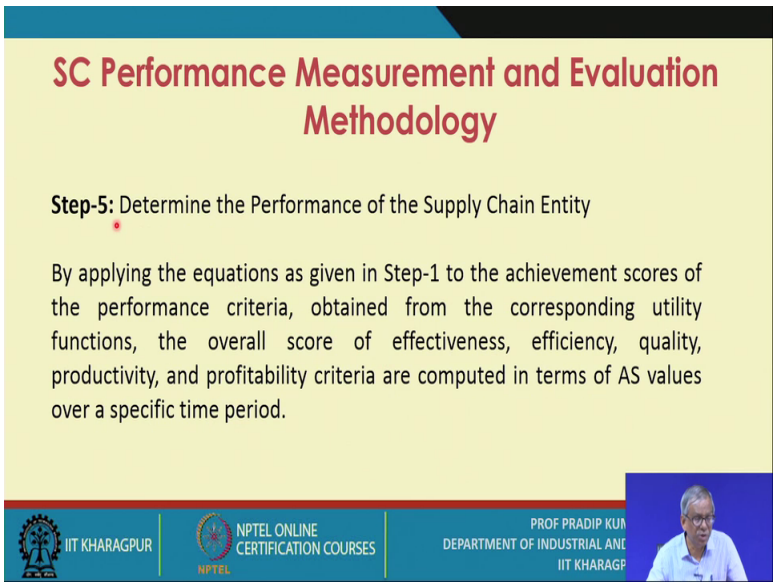

Then you move to step 5 you determine the performance of the supplies chain entity; that means, either say now the supply the link or say the focal company or you know the delivery link. So, by applying the equations has given in step 1 to the achievements scores of the performance criteria obtained from the corresponding utility functions, the overall scores of effectiveness efficiency quality productivity and profitability criteria are computed in terms of AS values over a specific time period.

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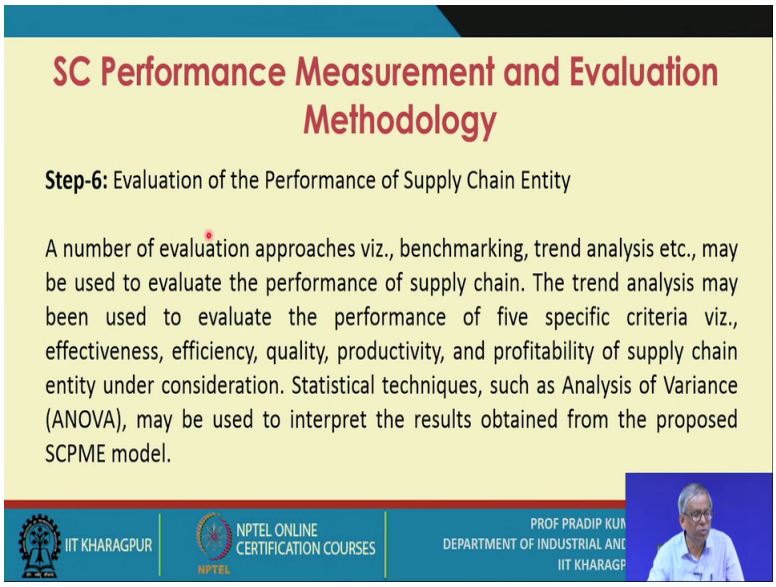

Now, when you move to step 6 what do you do you evaluate the performance of the supply chain entity, a number of evaluation approaches what are those you must be aware of benchmarking trend analysis etc may be used to evaluate the performance of supply chain. Now the trend analysis is preferred many a time use of benchmarking is a is a complex exercise, so at the first step or the you never go for benchmarking first you go for the trend analysis.

So, the trend analysis may be used to evaluate the performance of 5 specific criteria of supply chain entity under consideration. And the next what you do the statistical techniques such as analysis of variance. So, the Anova may be used to interpret the results obtained from the proposed say the comprehensive model.

So, here are the main the issue is that how to identify the performance measures and what are the relevant say in the performance criteria. So, as you might have noticed that

that this particular comprehensive methodology you can use, even if there is a large number of members in the supply chain network.

So, my suggestion is all the references are given, so you refer to say the reference text books and go through the details and obviously you know as a learner you may have several queries and always you should be in touch with ah with me for clarifying any doubts and all and what we are this is the last session of.

So, the 2 in the 12 th week and; obviously, you know we have the covered all the important topics for management of inventory systems and the starting with the classifications of inventory problem, and ending with the say the logistics and supply chain management. And in between the several important mathematical models as well as you know you control the techniques for the inventory control for.

So, the inventory management we have proposed and online that the real time, the control systems for inventory management when for the mathematical modeling maybe the difficult. So, we like say MRP systems MRP 2 systems and the DRP systems all these details we have discussed and you have come to know that under would situation you need the 2 apply the mathematical model, and in which situations you must go for say online real time control systems and now we are talk about the inventory systems.

But you might have noticed how the inventory system is linked with the production systems or more specifically production control is very much dependent on the inventory control and what is important is the whether you apply or the traditional approach or you applies the JIT based approach or the TOC based approach or say you go for say analysis of the supply chain management systems.

Say two important aspects you need to consider one is the to what extent you are you are able to reduce are the order quantity as well as the inventory investment and the second important aspect is that what extent you are able to the maintained the flow of materials within your the production systems as well as in the inbound logistics and outbound logistics for exclusively for the created for or the designed for your company. So, with this I conclude the sessions so.

Thank you so much.