Management of Inventory Systems
Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering
Indian Institute Of Technology, Kharagpur

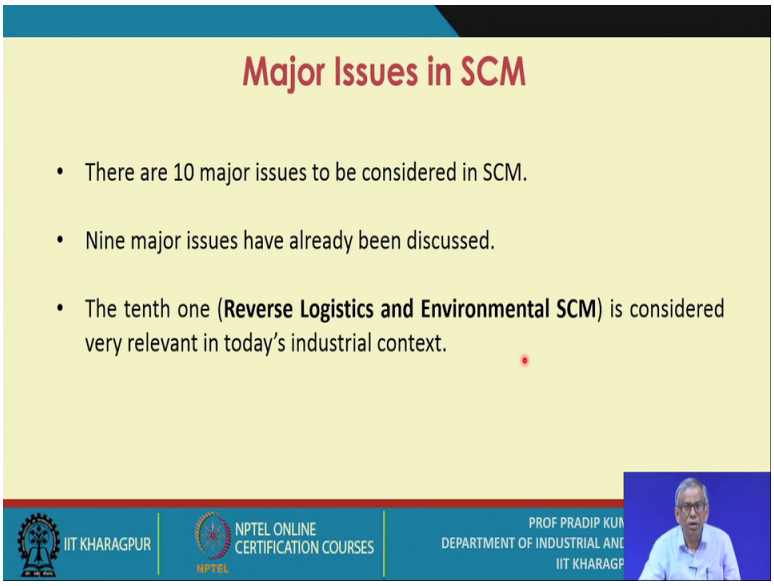
Lecture- 59
Logistics and Supply Chain Management
(Contd.)

So, during say this session on the Logistics and the Supply Chain Management, I will be discussing two important the topics.

(Refer Slide Time: 00:25)

The first one is reverse logistics and environmental a supply chain management, which is also referred to as the green supply chain management. So, this is an important issue I am going to discuss this aspect. And supply chain performance measurement system is essential in today's industrial context of or the majority of the organizations. So, hence as a learner you must have adequate knowledge on how to measure and evaluate supply chain performance. As you might have noticed that the supply chain are the management actually is related to managing the supply chain the network.

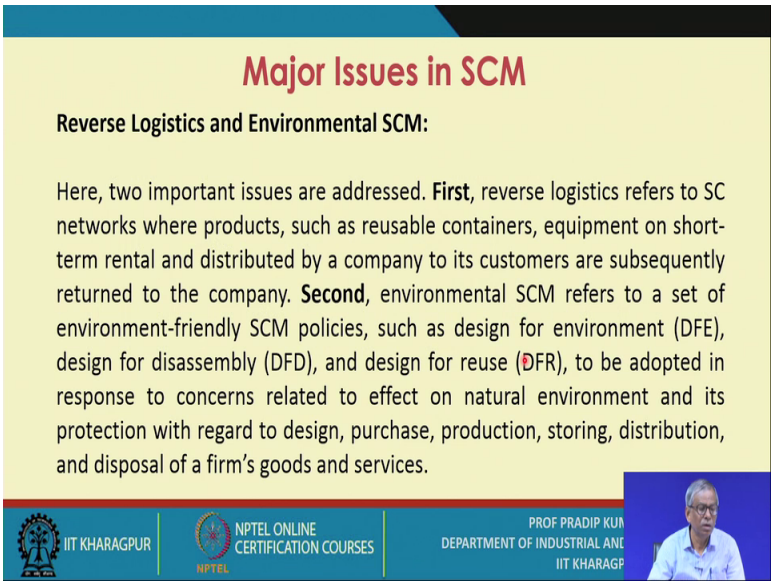
(Refer Slide Time: 01:34)



And there are the different issues involved while you try to manage the supply chain network. I have already mentioned in the last lecture session, what are the major issues to be considered in supply chain management; is like set concept of 3 PL or say 4 PL, then the transportation and the selection of supply of etcetera, etcetera. So, there are 10 major issues you need to consider, and considering the other present you know the status or the present state of the supply chain say the network for majority of the companies.

Now, already I have discussed the 9 major issues. Now the remaining one is obvious reverse logistics and environmental SCM. So, that I am going to discuss now. And in today's industrial context, this particular issue we cannot avoid, and that is why we always say that the reverse logistics and environmental supply chain management has become highly relevant for overall supply chain management or any organization.

(Refer Slide Time: 03:23)



Now, what is this reverse logistics and environmental supply chain management? So, the first we should understand what is reverse logistics, and then at the next step we will also bring in the issues of so, environmental supply chain management. So, as the name suggest, here the two important issues are addressed. The first one is the reverse logistics and the second one is environmental supply chain management. Now what is the reverse logistics? Now reverse logistics refers to the supply chain networks, already you understood what is a supply chain network, what are the members in the supply chain network.

Now, it is essentially a kind of supply chain network where the products such as reusable containers, equipment on short term rental and distributed by a company to it is customers are subsequently returned to the company; that means, you know when you use the term product in the supply chain management concept. Now, the product has got a wider connotation the meaning, in the sense that there are different types of the products or say you know the parts or the components they are in circulation in the supply chain network at different points in time.

Now, what you need to do? That means, you are first exercise is classification of all these products; which are in circulation in the supply chain network. Now, what you find that for transporting the materials or for storing the materials or are the products of the different types, you need to use the containers of different types of different sizes, then

you may a hire different kinds of equipment. That means, on rental basis, and what you can do that means, there are many items you can also distribute to your the customers. So, these are essentially you can reuse. So, what is important is the these are what you try to do are the make sure that that you create a separate or say or say parallel, you know, the logistic systems with which these units of the products or these types of products are returned to the company, ok.

Company real basically the focal company and so this you know this aspect must be there in the supply chain management. And what you can there are a many advantages, you may have if you the, create your reverse logistics systems. So one by one we will tell you will discuss all these aspects. Now this is the first thing you do. And in the next important issue is the environmental supply chain management.

Now, what is environmental supply chain management, or sometimes it is refer to it is a green supply chain. It refers to a set of environment friendly, supply chain management policies, such as design for environment, ok. So, when you talk about say the product design, it has got several dimensions, like say the design for assembly design for maintainability, design for serviceability. Similarly in today's context, you must adopt the concept of design for environment.

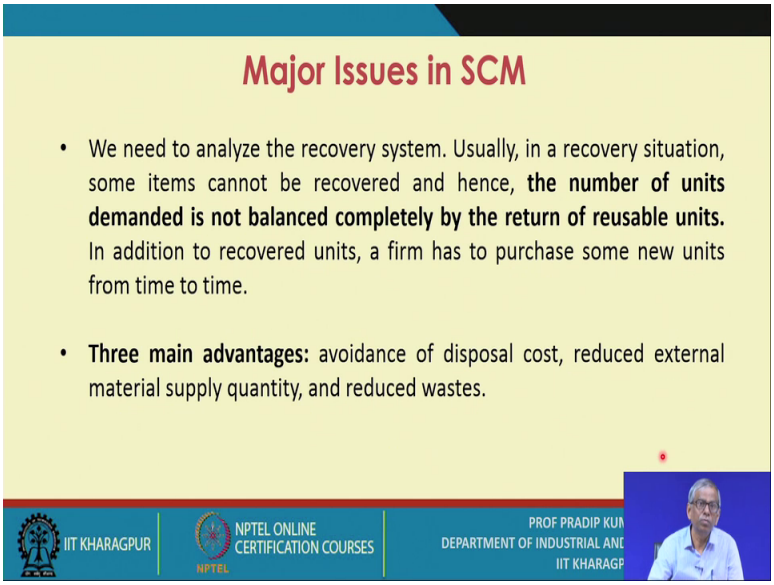
Similarly, the design for disassembly and design for reuse. So, these are the specific aspects as far as environmental management is concerned, you must adopt this design principles, and there must be you know the complete methods for using or for implementing the concept of design for environment, design for disassembly and design for reuse for the product which you are going to say the produce, and which you are going to you know the supply to your customers as per the demand.

Now this environmental supply chain management that means, it refers to the SCM policies using all these the design approaches, and this is to be adopted in response to concerns. Now, this point to be noted; adopted in response to concerns related to effect or natural environment; that means, your product which in circulation in the supply chain as a network, it may effect of the state of the natural environment. Like say the air pollution or say you know it can say water contamination, or it can have effect on say the land the land degradation.

Then it might affect the flora and fauna, and as well as the occupational health of the persons directly involved and plus are the people at large. So, this is very, very important issue so, and the these effect on natural environment you must know, and it is protection with regard to design purchase production storing distribution and disposal of a firms goods and services. That means, at all these the stages like the design stage, purchase stage you may carry out certain activities; which may directly affect the quality of the natural environment.

Now, it is your responsibility to protect the natural environment from the many kinds of the real effects; which you may have a at all the stages of in the supply chain network. So, this is the basic issue, and the today what has happened that not only you need to pursue your financial performance, but simultaneously you need to assure your environmental performance of management systems.

(Refer Slide Time: 11:43)



So, environmental SCM has become very, very important are highly relevant in today's industrial context. Now we need to analyze the recovery system. So, in the reverse logistics you know you have this SCM network. Now are you in a position to identify these recovery systems. So, usually in a recovery situation, some items cannot be recovered, ok. It is bound to happen in fact, and hence the number of units demanded is not balanced completely by the return of reusable units; that means, certain also the

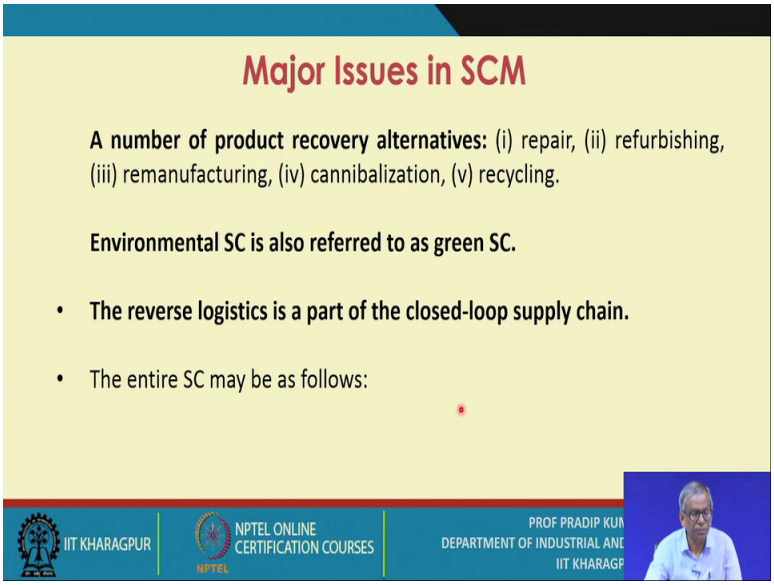
quantity a proportion of or say is a percentage of say the number of units which supply which supply to the customers, ok.

It is just not possible to get back the entire amount. Because there will be the disposal there will be say there will be disposal after used there could be say the wastes. And so, obviously, the recovery just cannot be 100 percent in almost all cases. So, in addition to the recovered units a firm has to purchase some new units from time to time. So, this is this is the general rule and yes; obviously, there is a reason for this one.

So now, to what extent; that means, this recovery are the proportion should be as high as possible that means, you create your say the network in such a way, you apply you are the technology in such a way used you select the material in such a way, you select the processes are the machineries are the you carry out the operations in such a way, that the recovery is maximum. Three main advantages, what is the three main advantages? First you note down the first one is avoidance of disposal cost.

So, if the recovery is more; obviously, are the disposal will be less. So, the disposal cost will be reduced. Reduced external material supply quantity so, this is the main advantage; that means, what you find, that if you analyze the product cost, you will find the maybe the material cost of contributes the maximum to the total product cost. So, if your recovery is more; that means, you will have reduced external material supply quantity. And obviously, there will be reduced wastes.

(Refer Slide Time: 14:56)



Now, what are the say product recovery alternatives? And the many companies they try with all these alternative. So, you must know at this stage that what are these are the recovery alternatives. So, we have listed down are the 5s specific alternative, the first one is a repair; that means, the system has broken down, and, but it is repairable, is it ok? That means, what you need to do; that means, it is a maintenance problem, and the there is fault diagnosis, and then ah; obviously, you go for troubleshooting and so, the repair is possible. So, this is one product recovery alternative. The second one is the refurbishing this is obvious.

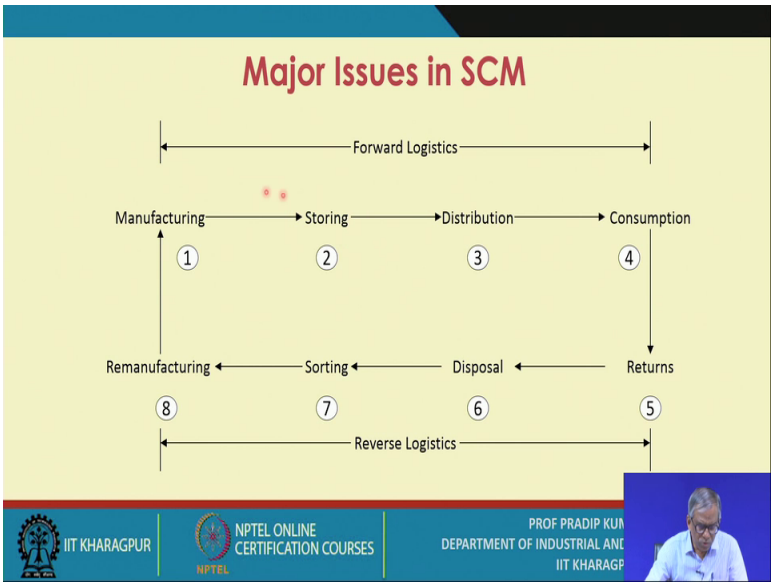
So refurbishing is another important are or well adopted alternative for product recovery. Third one is a remanufacturing. Now the remanufacturing has been adopted in a by many many organizations. Sometimes you know it is referred to as one aspect could be the machine reconditioning, ok. Because you know buffer a for any plant you have your the machineries, and before for the machinery is economic life is over or suppose is functional value is gone, before you dispose it to dispose it off there could be you know say, the remanufacturing or there could be you know the reconditioning of this plants and machineries.

So, this is well adopted the by many many organizations for the last many decades. Then the fourth one is cannibalization. So, this is very, very important; that means, suppose you produce say a 4 types of products and there are some common items. So, what you can do? That means, supposing for doing assembly for a particular product that for that particular certain you know sub assembly components are not available. So, what you can do? Or the time being so, you can have say are the components. So, similar components are identical components from another product range from another product and use it for so the current product.

So, this is referred to as a cannibalization, what is it cannibalization is essentially a short term measures. So, you try to avoid cannibalization, but this is also well adopted and this is considered to be one of the product recovery alternatives. And the last one is obviously the recycling. So, these are the 5 alternative repair refurbishing, remanufacturing, cannibalization and the last one is recycling. Now, when we talk about environmental supply chain, is also referred to as so the green supply chain. And what you try to do; that means, the reverse logistics is a part of the close loop supply chain.

So, usually when we propose the supply chain network, it is usually it is a close loop close loop supply chain. And if it is close loop supply chain; obviously, the reverse logistics is feasible. But if it is an open loop supply chain, then are you do not believe primarily in the concept of reverse logistics. Now, how do you the represent and close loop supply chain. So, in the close loop supply chain you have the forward logistics and you have the reverse logistics.

(Refer Slide Time: 19:27)



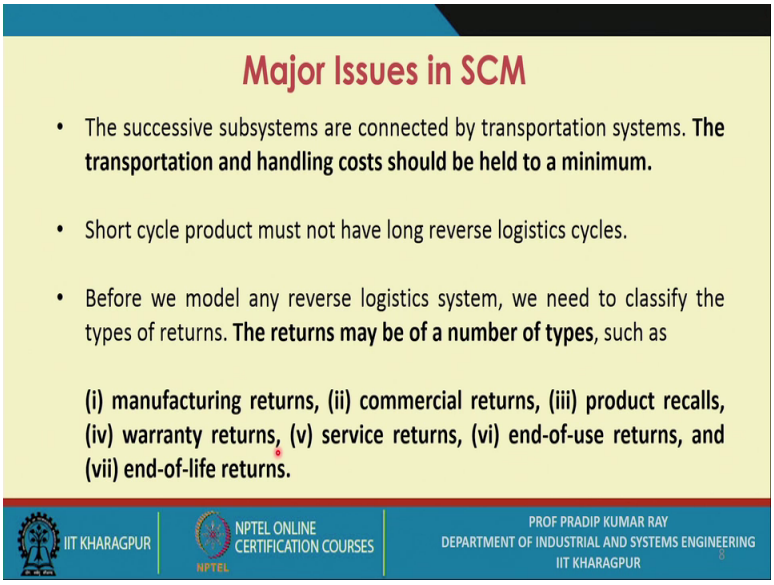
In the there are 8 principal you know the elements in this in this close loop supply chain. So, in the forward logistics what you have; that means, first is manufacturing then the storing, then distribution and then the consumption; that means, the product has reached at the customer's level. So, this is referred to as a consumption that means you start using it. After so a you create a logistics system in such that certain amounts of are the products are returned, and there could be many reasons for return right will is assume will come to know, what are the possible reasons of returning.

So, certain proportion is returned, and out of this return amount you have to dispose; that means, they are not in say, but they cannot be used so they are to be disposed. The remaining amount or the remaining the types of items which have been returned, which are you feel that it can be reused. So, there to be properly sorted; that means, there could be, but the different types, and they should be with the sorted based on their the condition, based on the type and all. So, this sorting is an important activity, and once

they are sorted then you may go for remanufacturing, is it ok? So, in the forward logistics you have these 4 elements, and in the reverse logistics you have again 4 elements.

So, you were note down all this work elements and so what you try to do? When you emphasis or emphasize on say the reverse logistics, this reverse logistics elements, all these actions should be strengthened, and there should be the proper monitoring and control of all these are the 4 activities. And everywhere appropriate technology you need to use.

(Refer Slide Time: 22:09)



Now, the successive subsystems are connected by transportation systems, now what actually we are referring to? That means, between these 2 elements, that the transportation activities you have to carry out; that means, between any 2 elements there must be they transportation activative. So, there could be different types of transportation systems, depending on the a number of factors, are say the material handling systems you have to by used.

The transportation and handling cost or material handling cost should be held to a minimum. Short cycle product must not have long reverse logistics cycles. So, this is very, very important in fact. So, what happens actually? If you have a long reverse logistics cycles, or obvious reasons there will be the less recovery, and ultimately it may not be beneficial at all the cost effective.

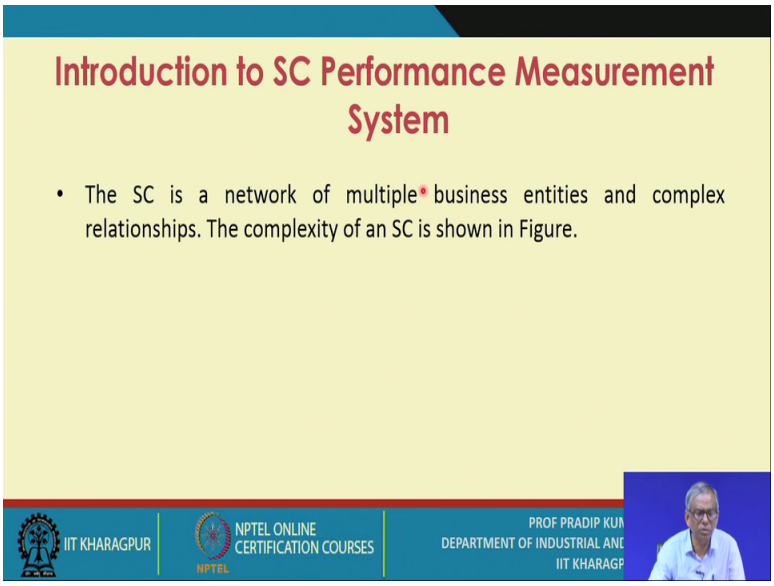
So, this point you must note down; that means, short cycle product and you must be very, very careful; that means, you can definitely go for reverse logistics systems, but make sure that it is not a long reverse logistics cycle. Before we model any reverse logistics systems, we need to classify the types of returns I have already mentioned, there these are the types of returns are you must know.

Another the returns may be of a number of types such as manufacturing returns, ok; that means, you have during the manufacturing stage, rights so; you face lot of problems say manufacturing problems you face. So, you cannot rectify in the problems, you cannot over comes the problems. So, this is referred to as the returned from the manufacturing systems. Then it is a commercial returns, ok; that means, the customer has not accepted, your product whatever may be the reasons, is it ok?

So, this is the commercial returns, the product recalls; that means, suddenly I find that there are some say some deficiencies in the product. So, I as a company, I company representative I take a decision that I must go for product recalls. Then voluntary returns yes; obviously the warranty that means, it is within the warranty of the item has failed. So now it has it has been returned to you and you go for the repairs and maintenance work. The service returns ok, this is one and end of use returns and end of life returns.

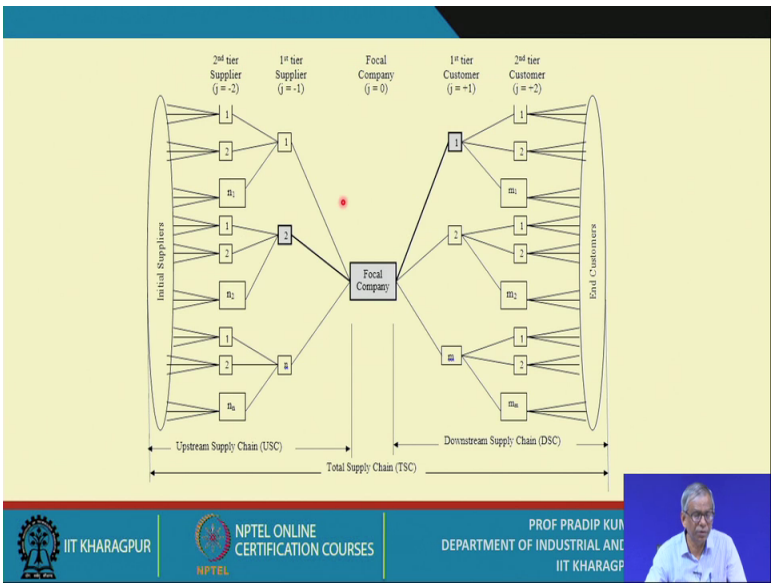
So, end of use returns and end of life written. That means, here say you we use it, and then you say I cannot use it further or any more so, and returning it whereas, end of life written means now it is essentially a disposal.

(Refer Slide Time: 25:42)



So, these are the possible types of returns as the supply chain is a network of multiple business entities and complex relationships. So, it is the network of multiple business entities and the complex relationships. And the complexity of a supply chain of an SC is shown in figure.

(Refer Slide Time: 26:06)

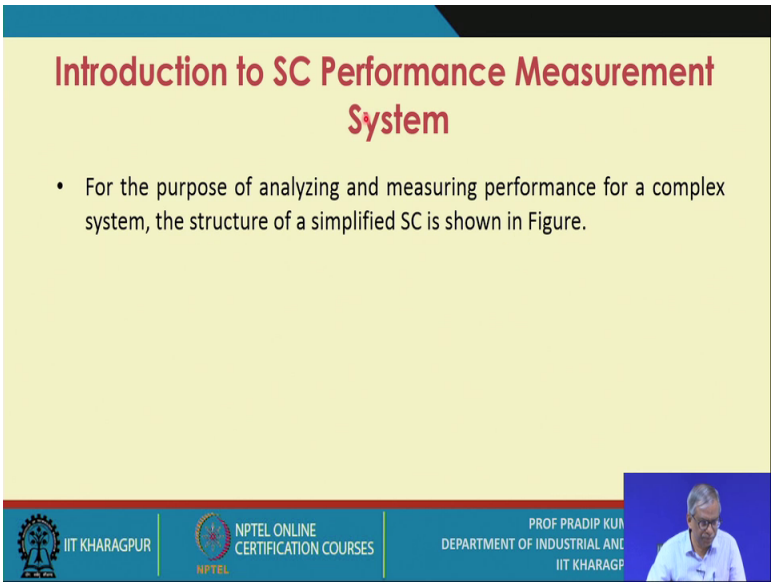


So, this is a if you look at this particular network, you can a while imagine how complex the system is. So, here what you have? That means, this is the total supply chain you already you know refer to the supply chain network. So, here is the focal company, and

you have actually first tier suppliers, then you have the second tier suppliers, and ultimately you reach to this level that is the initial suppliers.

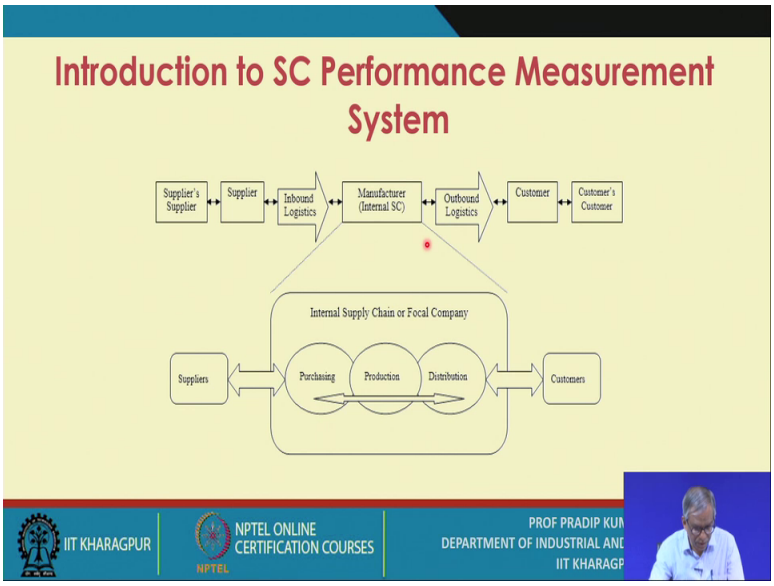
Similarly, on the on the right hand side you have. So, the first tier customers, then the first tier customers are linked with the second tier customers. And ultimately you have the end customers. So, this is referred to as the downstream supply chain, and this is the upstream supply chain, ok. So, and so this way you represent the supply chain network.

(Refer Slide Time: 27:07)



Now, for the purpose of analyzing and measuring performance for a complex systems, likes is supply chain network the structure of a simplified SC is shown.

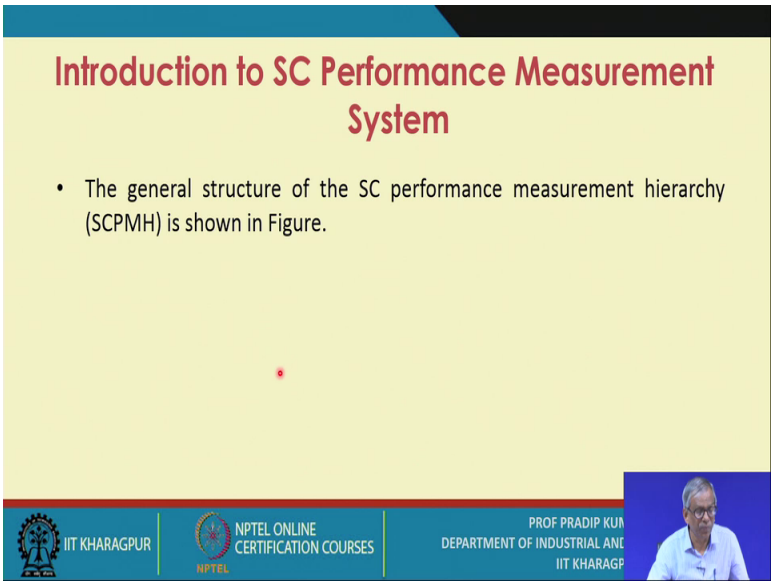
(Refer Slide Time: 27:21)



So, this is the simplified the structure or main purposes is that the supply chain you know the performance measurement systems you must have, ok. So, there are many advantages and so the many the companies, ok. So, say they prefer using are the different types of say the approaches for supply chain performance measurement and evaluation. So, this is the supplier then you have the supplier inbound. So, you have the manufacturer so it is an internal supply chain.

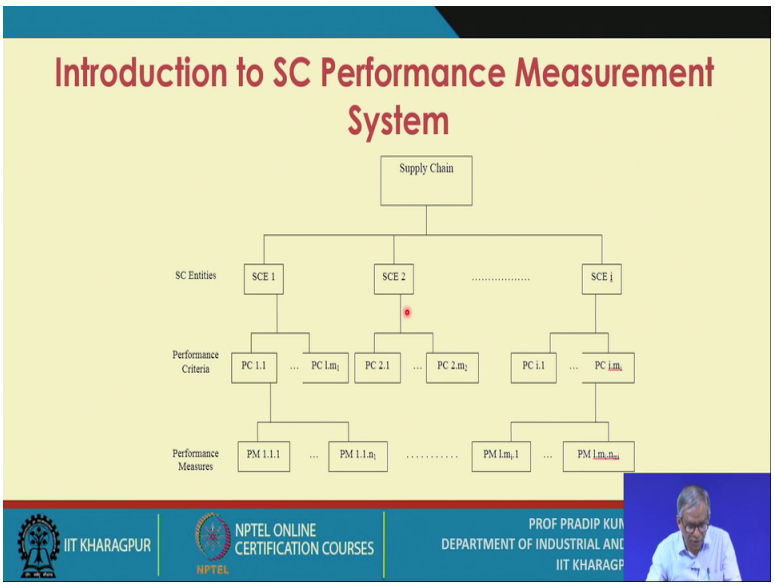
Then you have the inbound logistics, already we know what is inbound logistics, and this is the outbound logistics. So, you are directly dealing with your customer, and your customer is dealing with another customer. So, this is the referred to as the customer customers similarly the supplier. So, this is your internal the supply chain on the focal company; that means, you have purchasing department we have already discussed, then you have the production and then you have the distribution. And then you are a interacting with the customers. So, similarly the purchase department is directly interacting with the suppliers.

(Refer Slide Time: 28:45)



So, the general structure of the supply chain performance measurement hierarchy is shown in figure.

(Refer Slide Time: 28:53)



So, you just refer to this figure again in the next lecture sessions we will be discussing are the supply chain performance measurement systems in detail. But here what you are trying to do? That means, with respect to supply chain, you must be able to identify the supply chain entities, ok.

So, these are the entities, next against each of these entities, you need to identify we need to select, the relevant performance criteria. And once you select a particular say a set of criteria, then again against a particular the performance criteria, you need to identify or you need to select are the relevant performance measures.

So, this is the level 0, level 1, and level 2. So, this way you create this hierarchy, and then you propose an appropriate supply chain performance measurement and evaluation systems. So, with this you come to know, the two important aspects, one is that what is this reverse logistics as well as environmental supply chain management, and why this issue has assume importance in today's industrial context, and how to identify the relevant parameters and the factors. Say, the related to this important issue this is one aspect and the second aspect is what we have discussed.

During this lecture sessions we have just introduced the concept of the supply chain performance measurement system; for which a particular say the methodology we have to follow, and this the methodology we are going to discuss in our next lecture session.

Thank you.