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

Lecture- 57
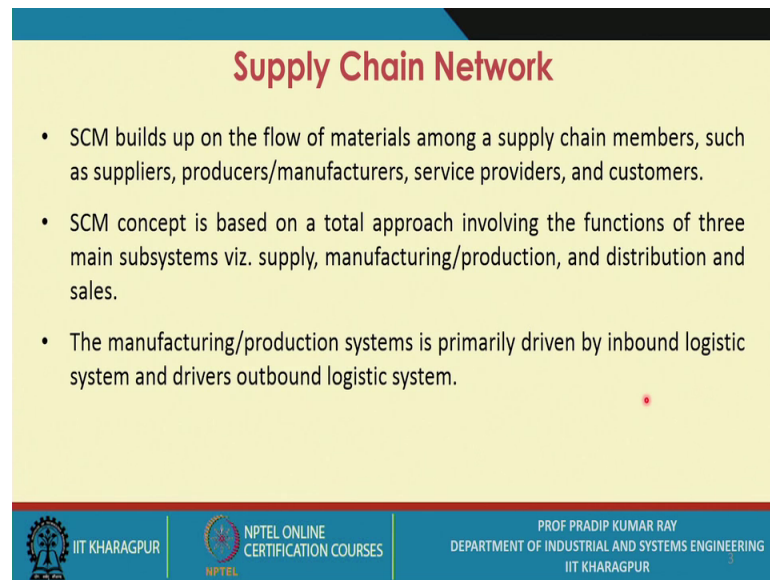**Logistics and Supply Chain Management (Contd.)**

During this the lecture session on Logistics and Supply Chain Management.

(Refer Slide Time: 00:22)

I will specifically the discuss the supply chain network. Now, I have already discussed in the first lecture sessions, if you remember the basic issues, we must be dealing with while we go for the supply chain management.

(Refer Slide Time: 00:34)

And the supply chain when we go for supply chain management so, we need to define what is a supply chain, we have defined the supply chain. And in the entire supply chain, what you will find the there are many members in the supply chain. And there must be proper say the coordination with proper integration among these supply chain members.

So, and what is important is a being a member of the supply chain a particular entity or a particular function, the must work must work considering it is say its relationship with a say the you know say the forward are the functions, as well as the precedent preceding say the functions.

So, related to a particular say the member in the supply chain, you have the preceding function as well as you have the succeeding or succeeding or subsequent functions. So, you are the function as a member depends on say to what extent you get the support from say the previous, say the functions as well as in the succeeding functions.

So, ultimately each member of the supply chain is working in a particular network. And depending on the type of the product is use, and the type of say the manufacturing systems so, the types of the supplier base the types of, say the customers based that you have at a particular point in time you work in a particular network.

So, defining or say you know or the documenting the supply chain network is a necessary condition; that means, the starting point is that you must be able to say the

represent you are the represent a document your supply chain network. And while you represent the supply chain network, the kinds of relationships kinds of when the dependencies you have, the kinds of say the independence you have, all the details will come to know.

And the at for each member of the network what are the specific objectives of you need to fulfill all these details you need to know. And what is important is that all these issues we need to the quantify and for a while you try to model a supply chain network you also must know that for whom for which particular member, you are your modeling the problem for your formulating the problem.

Now, supply chain management builds up on the flow of materials among a supply, among the supply chain members such as suppliers, producers, manufacturers, service providers and customers. So, they are the supply chain members who are they definitely the suppliers are there, producers of manufacturers then the service providers and the customers, ok.

Now, supply chain management concept is based on a total approach involving the functions of 3 main subsystems, ok. Is just note down these 3 main subsystems what are those? First one is the supply subsystem, second one is the manufacturing of the production subsystems, and the third one is the distribution and sales say systems, subsystems plus you know; obviously, the supply systems maybe intimately related with many other sub subsystems.

So, while you we develop a the network in network of say the supply systems, you should consider all those sub subsystems are also. Similarly, for the distribution and sales and so, that is very, very important and similarly when you go for presenting your manufacturing and production. So, what are the you know say the subsystems within the manufacturing of production system.

So, that also you must be able to identify. And the manufacturing of production system is primarily driven by inbound logistics systems, and the drivers and the drives outbound logistics systems. So, that driven by inbound logistics system; that means, your supply systems is basically controlling your activities being the manufacturer or the producers. And, but you as a production system drives the outbound logistics system.

So, you have the 2 kinds of say the logistics systems one is inbound logistics, and the second one is the outbound logistics. And between these 2 logistics systems you as a manufacturing system, you were working as a manufacturing system. So, you are linked with the inbound logistics as well as outbound logistics.
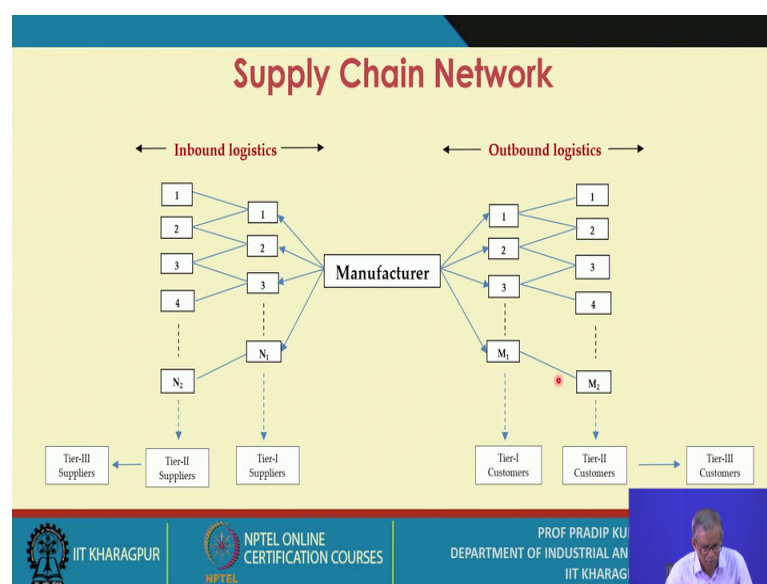
(Refer Slide Time: 07:22)

The SC network typically represents the flow of materials from inbound to outbound logistics systems through manufacturing or factory system.

(Refer Slide Time: 07:50)

So, within each logistics systems, there may be a number of firms, a typical SC network is shown in the following figure. Now, let us talk about say let us discuss the supply chain network. Now here what you mention that your here is the manufacturer, or the main company; for which the supply chain network is to be known. Obviously, you have you are you a linked with the inbound logistics systems, and you are also linked with the outbound logistics system.

Now, here what we have found that the first you as a manufacturer. You are linked with this set of say the suppliers, ok. So, this is your supply base so, how many the suppliers you have right now, that is basically say capital N 1, number of suppliers you are dealing with right now is a manufacturer.

And obviously, you know as we have pointed out during say the discussions on make or by in the few decisions in purchasing management so, this so, the number of suppliers with whom you are dealing with depends on how many the components say are the parts or the materials you are going to procure for as direct materials as well as for the indirect materials.

So, that decisions already have taken. So, at a particular point in time you are dealing with directly capital N 1. So, say 100 suppliers or 200 suppliers were dealing with. They are referred to as the tier I suppliers. Now, this the item which a particular company supplier company supplies to you a particular item.

Now this particular item to itself your product or and for making this product, this the supplier company may be dependent on another supplier, is it ok? So, all these individual supplier companies, they have their own you know the supplier base ok, maybe your item is just a one of it is say the product mix, one of the item one of the product in it is product mix.

So, the company is also having say each company has it is own say set of suppliers. And these companies are referred to as the tier 2 suppliers. And similarly all these companies they have own set of suppliers so, this way you proceed like say then you move to tier 2 supplier tier 3 suppliers and so on and so forth. So, and all are interlinked; that means, suppose the supply is disrupted from say from tier one supplier to you; you as the manufacturer, now this could be the reason could be that are the disruption is due to non-availability of a particular material required of for your item to be supplied by a.

But if this company, and a non-availability from this company supplier. So, these are all interlinked in the, similarly availability or non-availability so, the depends on the kinds of so, the interactions so, the kinds of flows you have at a particular a point in time between the suppliers at different tiers, is it ok? And this is affecting your say the flow of materials within your manufacturing plant, is it ok? So, this why you present the network.

So, on one side and you are say you are affected by the performance of your inbound logistics systems, and the other hand, when you produce a product that is the end item or the finished goods you produce. So, you send it to your the customers directly. That means, these are referred to as a tier 1 customers, ok. And this these are all customer companies. So, for those the companies you are you are becoming a supplier.

So, you as a supplier, you are sending the finished goods to your customer companies. And these customer companies they are acting as a supplier to their you know to their customers or to their customer company. So, from tier 1 customers, you move to tier 2 customers; that means, why the customer needs your item, you are in the item because it is company it is the customer company is acting as a supplier to another company.

So, these are the companies; obviously, for all these customers of yours, they are in the tier 2 customers category with respect to your company or with respect to your manufacturing system. So, this way there maybe the customers at different tires, is it ok? Like tier 1 tier 2 tier 3 and so on. So, this is the entire network, and what might happen? Like so, the your performance as far as flow of material is concerned, as far as you know the inventory so, the level is concerned.

Maybe the dependent on the performance of all the suppliers at different the tires as well as the performance of say the customers at different tiers. So, this is the entire network and you might have realized by this time, that say how do you say so, how complex the system is. So, that is why you find the supply chain management deals with the several kinds of the complex problems.

And here what is important is that while you go for analyzing a problem; that means, of from which perspective say you are looking at the problem you are formulating the problem that is very important. That the second one is that say for whom for which member of the supply chain your formulating the problem so on. And so the unit of

analysis determining the unit of analysis from for problem formulation and solution is a is an important issues.

(Refer Slide Time: 15:51)

Now, there are certain say the comments we can make on while you study the supply chain network. For effective control including timely actions related to the activities of any member of the supply chain you have identified or who are the members of the supply chain already you have identified them. Assurance of timely and accurate information related to flow of materials and it is implication to performance and cost related parameters is very, very critical.

That means what is important is that always you are trying to so, the monitor the flow of materials within the systems, the different supply chain members. And for monitoring say the performance of your systems you must have timely and accurate information. Otherwise is becomes difficult to monitor and control say the flow of materials.
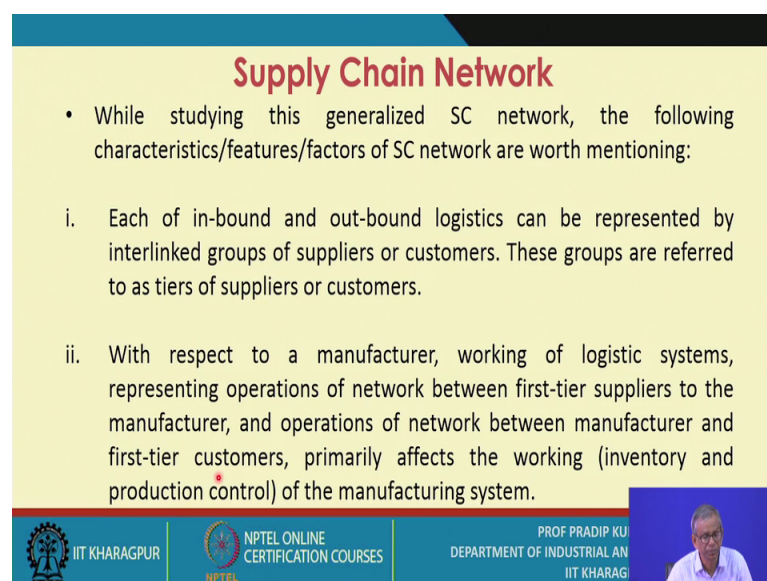
So, obviously, you know you get the information in such a way or that type of information you must be able to get at different points in time so that you are in a position to measure the performance of your supply chain and to and to measure say the cost involved, ok. For the activities you carry out, is it ok? So, what you try to do? That means, you try to identify the performance and cost related parameters, is it ok?

So, later on when we discuss the supply chain performance measurement and evaluation systems. So, we will discuss it in detail. So, what are those performance and cost related parameters, you must you look into. So, what I am emphasizing at this point is, that you create a supply chain that is a physical systems, but for monitor the performance of this physical systems, you must have appropriate the support from your information system. The flow of information in reverse direction from customer to manufacturer, is it? And from manufacturer to suppliers indicative of status of the availability of materials and resources is to be assured.

So, what we are trying to the develop not only a control system, but also you are trying to develop an assurance system, and that is your objective. So, the first when you create a control system; that means, we are we assume the there could be deviations.

But from the control systems if you can move to the assurance systems; that means, immediately you assume that there is the stability in the systems, and the entire performance is expected to be very, very lowest. That means, you have also of say the preventive as well as the corrective measures in built in the systems to take care of or to both the nullify the effect of so, the external factors, ok. So, then assurance systems we have to develop, performance of an SC network is significantly affected by this information system.

(Refer Slide Time: 19:53)

Supply Chain Network

- While studying this generalized SC network, the following characteristics/features/factors of SC network are worth mentioning:

i. Each of in-bound and out-bound logistics can be represented by interlinked groups of suppliers or customers. These groups are referred to as tiers of suppliers or customers.

ii. With respect to a manufacturer, working of logistic systems, representing operations of network between first-tier suppliers to the manufacturer, and operations of network between manufacturer and first-tier customers, primarily affects the working (inventory and production control) of the manufacturing system.

Now, while studying these generalized supply chain network, that means, what we have proposed that is a generalized supply chain network what is important is that any supply chain network must be must be you know the documented or must be presented with respect to a particular product or the service. So, that is very, very important. So, this for a particular say product or the service, you need to create, you need to document you are the supply chain network as of now. Now, the following characteristics features of factors of SC network are worth mentioning.

Now, first what you need to do? So, you need to present you are supply chain network, and then you need to assess or you need to know what are the it is characteristics features. The each of inbound and outbound logistics can be represented by interlinked groups of suppliers or customers, ok; that means, overall systems we have placed within each systems there could be many subsystems.
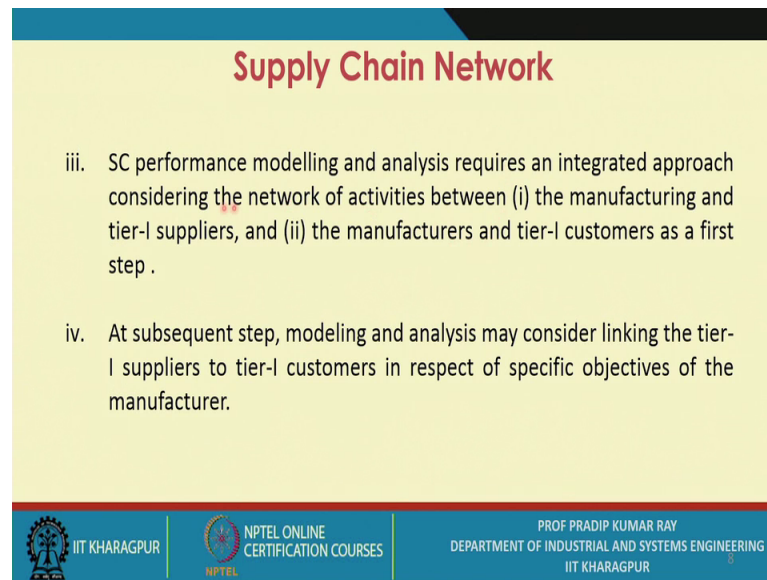
Now, these groups are referred to as tiers of suppliers of the customers have already explained in detail. Now, with respect to a manufacturer, working of logistics systems representing operations of network between first tier suppliers to the manufacturer this point is very important, the operations of network between first tier suppliers to the manufacturer and operations of network between manufacturer and first tier customers.

So, primarily effects of working of the manufacturing systems. Now, when you refer to the working of the manufacturing systems so, the 2 aspects we always concentrate. One is definitely the production control and the second aspect is inventory control, ok.

So, what we are saying that though the other factors; that means, the factors between the different tiers of the suppliers as well as the different tiers of the customers may definitely effect, but our major concern is what are the factors mainly, what are the factors prevailing you know between the manufacturer and the first tier suppliers and the manufacturers and the first tier say the customers.

So, this factors you must be we will to identify, and in majority of the cases will find say these factors between say first tier suppliers, and the first tier customers they are essentially or significantly affecting the performance of the manufacturing systems.

(Refer Slide Time: 23:14)

Now, supply chain performance modeling and analysis requires an integrated approach. So, the integration part is very, very important; like, when you talk about the CIM, Computer Integrated Manufacturing we say there must be integration and there must be automation. Whereas, when you deal with the CIB, Computer Integrated Business we always concentrate on the integration part.

Now, automation part is not necessary condition. So, it is very difficult to make the entire the supply chain network and automated system. In the limited scale you can do, but entire supply chain of for a specific product or a service becoming a automated and 100 percent integrated that is a really challenging task.

So, what we are trying to do? That means, an integrated approach you need to adopt and in this integrated approach you need to consider are the activities between the manufacturing and tier I suppliers, and the manufacturers and between the manufacturers and tier one customers as a first step. This you have to do initially, at subsequent steps modeling and analysis may consider linking the tier I suppliers to tier one customers in respect of specific objectives of the manufacture. So, use free tune activities on the different phases, first you concentrate on say the activities between the manufacturer and the tier I customers.

(Refer Slide Time: 25:14)

And then you go to consider are the activities between the manufacturer, and are the tier I the suppliers. And then you combined them a combine both.

So, this why you proceed and so, from so, if a model say which is the say approximate model, the slowly you wind up the exact model, ok. So, a step by step approach is a must. While modeling the distribution requirements planning there to systems we have already discussed.

So, refer to the DRP systems the outbound logistics between the manufacturer and the tier I customers need to consider, the flow of finished products or goods or end items through distribution centers like wholesalers and retailers, is it ok? So, that is sort of are the network you must create. Particularly for both types of products, industrial product as well as the consumer products. And number of IT enabled services, like e-commerce, EDI, bar coding and scanning, internet, decision support system, DSS etcetera should be used to facilitate the flow of information among the members of the supply chain concerned, ok.

So, this is to be done the storing methods at warehouses, ok. The stores management already we have dealt with as a could be different types of storing methods that is also we have already discussed.

The transport transportation methods used among the stores, and the corresponding the storage and transportation cost and performance; that means, transportation cost transport transportation performance are the critical factors to be considered to develop an efficient and effective supply chain network for a company; that means, between the 2 members of between 2 activities or 2 functions of the supply chain there is a physical flow, and for maintaining this physical flow of materials what you need you need different types of say the transportation system.

And today what has happened that you can have the different alternatives of different alternate transportation systems. And so, as you propose different alternate so, the transportation systems so, the transportation cost is considered to be a variable.

So, you have to select the best possible say the transportation so, the methods are considering the transportation cost in a particular case. Assessment of a given supply chain network requires identification of the key work elements of activities related to timely supply of materials in different forms at different control points across the supply chain.

So, you need to identify the control points. Identification and removal of non-value adding activities help in streamlining the flow of materials through the supply chain.
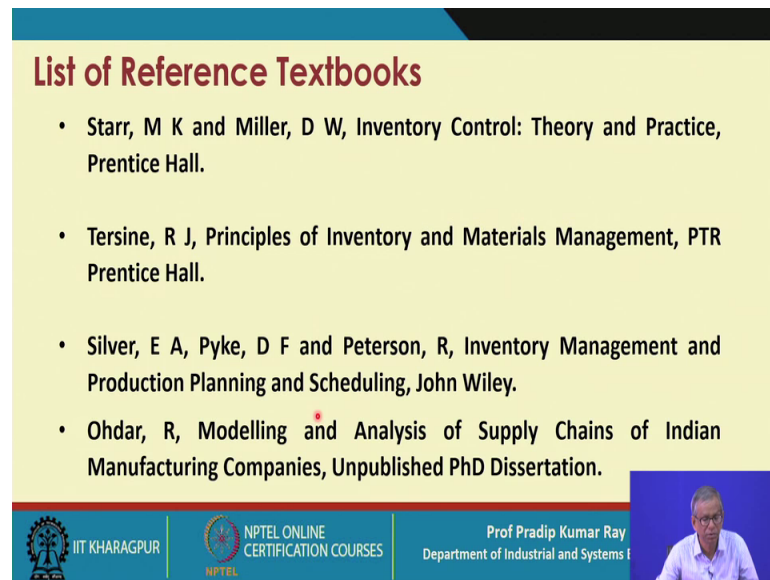
(Refer Slide Time: 29:01)

That means what we are trying to do to what extent you can apply the JIT based the JIT principles. A database performance modeling and analysis of supply chain network related to a specific product following the logic of pull system. JIT based approach and DBR scheduling is a necessity. So, you know what is a pull systems? You also know what is a JIT based approach in material and production control. And DBR scheduling as a part of say the theory of constraints. We have already discussed so, the DBR scheduling is a necessity, and these are the if you have if you are already on say you know what are these concepts.

So, try to use this concepts, adopt this concepts in the supply chain network. As there may be conflicting interests among supply chain members it is imperative that an SC modeling analysis refers to the interest of a particular member of supply chain.

(Refer Slide Time: 30:11)

So, with this, you know, I conclude by discussions on supply chain network. And this knowledge is this is a must; that means, while you try to model your supply chain network so the supply chain network in detail, what are the activities involved, what are the functions involve their relationships, what are the decision variables, you must first be able to identify them. So, this aspect is very, very important.

So, thank you.