Indian Institute of Science
Bangalore

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Global Supply Chain Management
Lecture -01
Introduction to Global Supply Chain Networks Part-1

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Yeah welcome to the course on supply chain management my name is vishwanadham I am from the department of computer science and automation at the Indian Institute of Science so today we will start with the first lecture.

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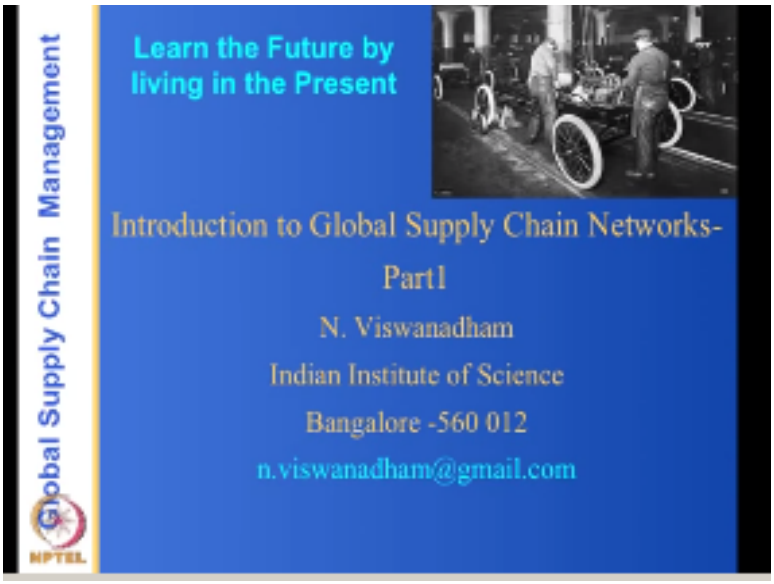

And you will see a picture on the slide that is the fold assembly line which is started in 1913 that is exactly 100 years ago and in fact the fold supply chain is the precursor to all the supply chain management and it has basically revolutionized the industry in the United States and also United States economy ,so I think what we are going to do in this series of lectures is to learn about.

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The supply chain management the globalization outsourcing and all the things like that but they are very important in my opinion and this first lecture.

I use an introductory lecture to supply chain networks so we will start with the introduction to the supply chain network so I will give some examples, so that the people are clear of the concepts but also I will talk about integrated supply chain networks which are basically the integration of goods movement of goods , finance and information and will just if possible try and end with the best practices in the supply chain networks so to start with the first slide as the introduction.

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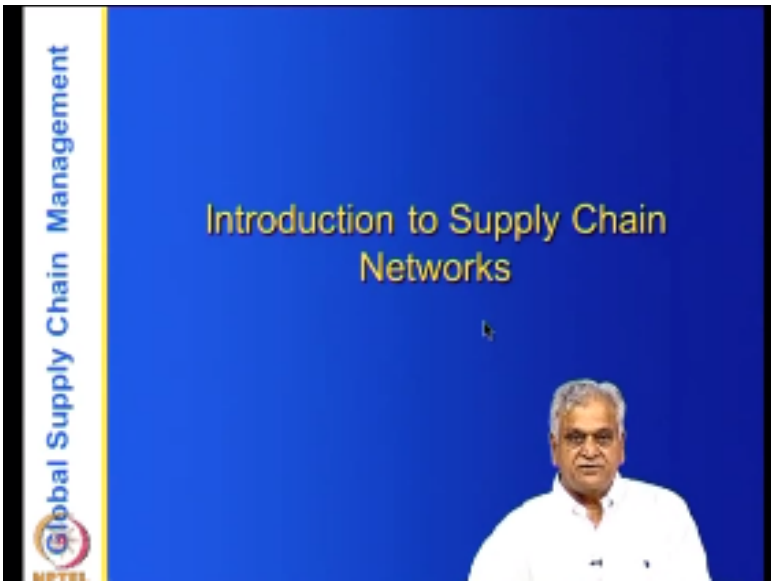

To the supply chain networks what are supply chain networks.

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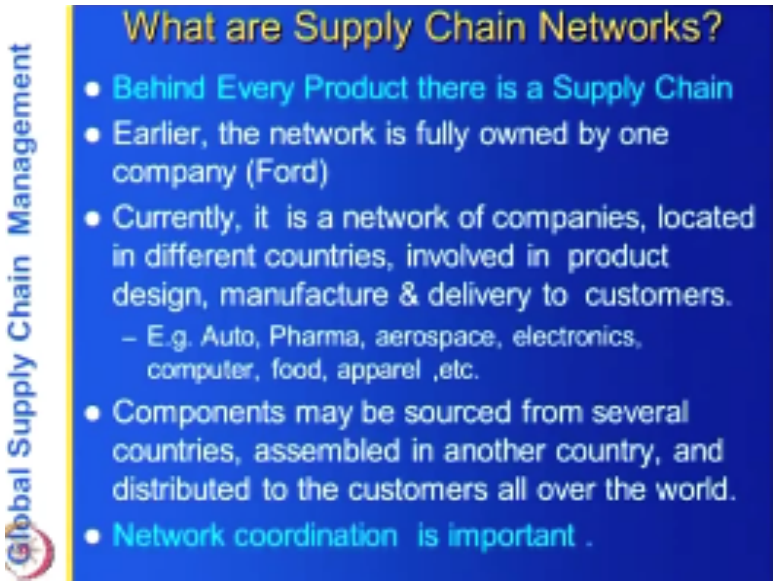

So if you look at this one behind over the product there is a supply chain in other words supposing you take a car or you take a cell phone or you take a PC or a laptop behind that they there are basically several companies working together to produce that particular product if you take the laptop there is Intel like thing which is making the processor there is a Lenovo kind of people who are making the all the other parts and there is somebody who is making the hard drive and somebody else the mouse and somebody else the screen and so on but everything is assembled and put together finally by somebody else so even every product that you take whether it is a food product.

Whether it is a car or this one there is a supply chain so it is very important we learn about the supply chain before because the product that you get the quality the cost and the usability are all basically influenced by the supply chain so earlier the network is fully one by one coming for example Ford in 1913 he used to warn the Iran, wars then he used toward the ship to carry the iron ore to the shores then steel plants used to only assembly plants and finally to let the car goes to the dealer full Ford wound everything, but currently it is the supply chain is not one by one single person but it is a network of companies.

But these companies need not have to be in the same country need not have to be speaking the same language but they are all involved in the product design manufacture and delivery to the customers so because there are several companies that are involved in the manufacture of this then there is there are some complications that occur , because if you to warn the company and

the company is has a president or the Warner who can dictate the terms but in the case of a network of companies it becomes difficult the governance of the company.

Becomes an important aspect well there are examples of networks of companies producing products on delivering to the customers they include in the auto industry in the pharmaceutical industry in the aerospace electronics computers food apparel etc. So any product that you have there are several a network of companies behind that particular product so components may be sourced from several countries assemble in another country and distributed customer all over the world so you can see that the when you are making a product there are several countries involved several companies that are involved and so a network coordination.

Becomes very important so to give you an idea of what our supply chain networks let me show you a diagram.

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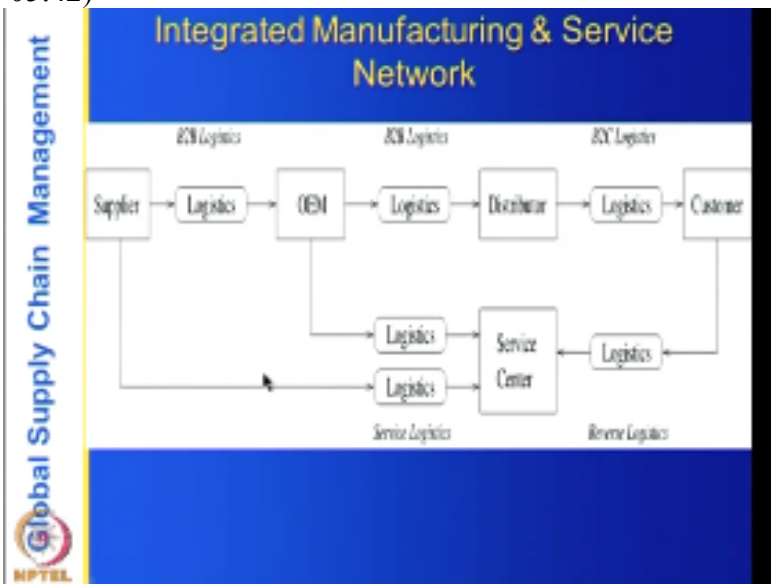

This is their supplier although I said one supplier there could be several suppliers here and from the supplier where means Original Equipment Manufacturer who does the basically they gives the design who understood from the components from the suppliers who does the assembler but from the supplier to the William or virginal equipment manufacturer there is what is called inbound logistics or b2b logistics business-to-business logistics that is involved and from the manufacturer to the products go to the distributor from the distributor.

To the customer via the retail outlets now there is a logistics that is involved because the material has to move from the manufacturer to the distributor this can be by a truck by Ryle by air whatever and from finally from the distributor to the retail outlet and the customers so if you look at this is called the forward supply chain which goes from the suppliers to the manufacturer to the distributor and to the customer but supposing once the customer gets the particular product like an auto or a car or a computer or something.

If you require servicing there are service centers and the customer has to take his product to the service center and the service center may require spare parts from which they get it from either the manufacturer or the suppliers and service it and return to the customer so basically if you look at this particular diagram it shows you the forward logistics the service logistics in this it is also called the reverse logistics.

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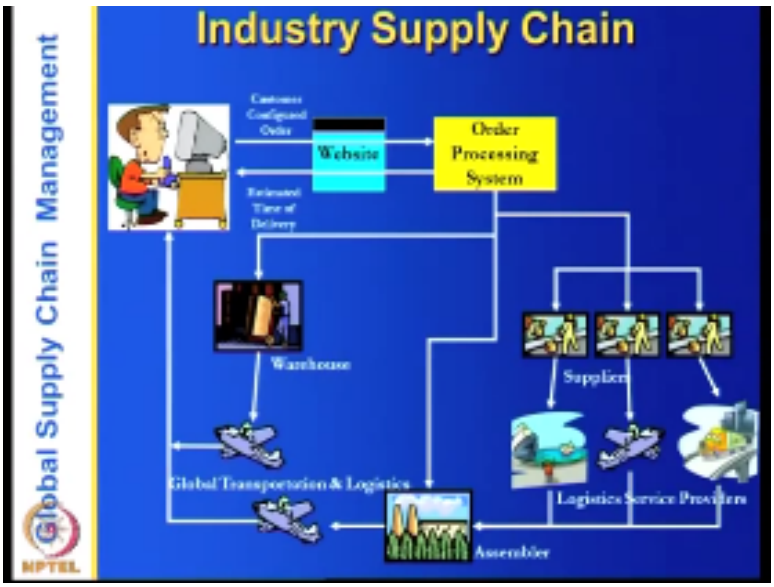

Let us look at some examples in this for example we have an industry supply chain where if you are a customer sitting at your PC looking at your website if you want to order say a laptop and then you go to the website and you go to Dell or you go to Lenovo or any of the company websites and start ordering the process once you order you pay the money through your credit card then if it is available in the warehouse then it is supplied to you immediately well supposing it is not available in the warehouse then it has to be assembled in other words depending on the configuration of your PC or depending on the configuration of your car.

It may have to be assembled to order and it is assembled and then delivered to you and supposing you have a bill to order in other words you have special considerations then you do not want the one that is either in the warehouse or it has with the standardized parts then the supplier has suppliers how to take your orders and they have to be assembled and delivered to you so this particular diagram is shows you the web ordering it assembles to order as well as built order they have three kinds of Industry supply chains that are involved today there is also .

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If you look at the agricultural supply chains it starts with the farmer farmers are the suppliers of agriculture products and this is also called plow to plate food supply chain and from whatever is produced they are transported to the Mundy's by or the distribution centers by the people in carrying on the it on the head and this is a kind of distribution center where these things are sold to the retailers and once they are sold to the retailers and the retailers are the one the street vendors who basically supply to you to bring it to your house and supply it and you cook it so this is called the plow to plate supply chain.

Now here you can see that the supply chain is ad hock and it goes from end to end and there are no basically nobody who is orchestrating the relationship among the supply chain actors which means if a retailer wants to get something he goes to they basically the Mandy or the

distribution center and from there and so basically the actors are not connected in this whereas if you look at the previous industry the supply chain network either when you are buying automobiles or when you are buying a PC or something they network the suppliers and the manufacturers and the dealers.

And the retailer's are very well connected and even the customer can transact directly with the particular with the suppliers and so on so but here this is the kind of this is the kind of cloud. To play food supply chain Network and this is why people say the Indian agriculture food supply chain network is sort of fragmented and inefficient it is inefficient because it is not connected there to among all the players are not connected and there is no ordering system here.

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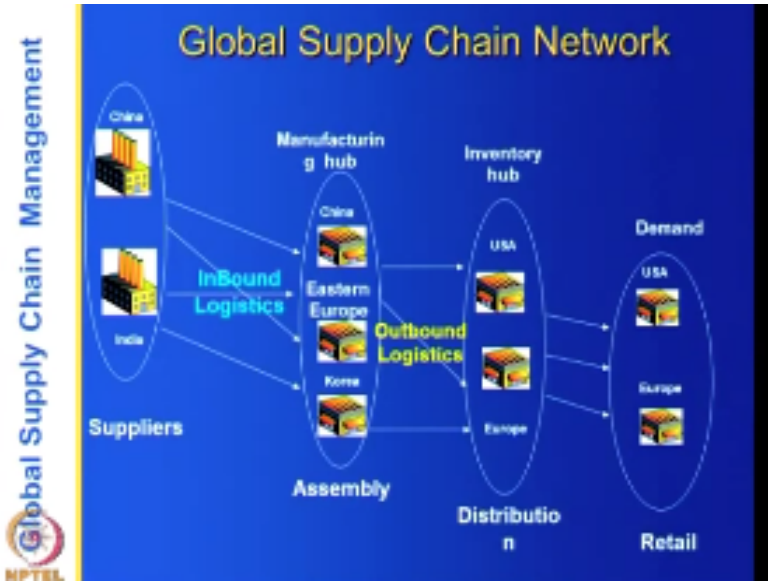

So if you take a global supply chain network where for example of the viewer if you have take a PC or a car then there are these what are called the suppliers they are either in India or in China and they're what are called inbound logistics players who basically sub take the material from the suppliers and supply to the manufacturers so in the manufacturing hubs it can be in China Eastern Europe or this one basically in the manufacturing hubs they assemble whatever they get from the suppliers and then it goes to the industry inventory hub or the dealers or the distribution centers and finally.

It was to the retail so the retail is the one that is in the US most of the global supply chain networks the retail is on the either in Europe or in or in USA and the tail end of the supply chain that is the suppliers are in the in Asia and there is a lot of logistics that are involved because there is the material movement that is involved from the suppliers to the assemblers to distribution centers and to the retailers and in the global supply chain Network there is a lot of material movement that is involved and the logistics players called the third party logistics players UPS DHL and several others have a large role to play.

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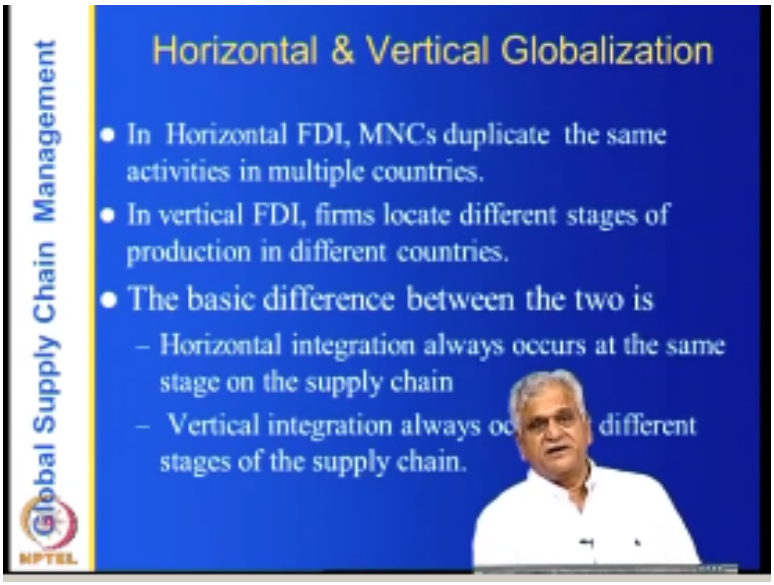

So if you look at global supply chains there are two kinds of globalization one globalization is what we call horizontal foreign direct investment FDI means foreign direct investment MNC means multinational companies, so in a horizontal foreign direct investment MNC is duplicate the same activities in multiple countries in other words if they have a factory to manufacture a car in Japan they will just come to India and then have the same kind of factory here and that means they require the same components either imported from Japan or some other place or they have to do duplicate even the suppliers here.

But on the other hand what is more prevalent nowadays is what is called vertical foreign direct investment where firms are located in different stages of production in different countries in other words the Intel chip is made in Malaysia and it is the power supply is made in India and the monitor is made in Thailand and all these are brought to the a particular country where it is

all assembled and which is close to the customer and they are delivered to the customer so what vertical FDI is basically components or manpower assemble components are made in various countries.

And they are assembled in a particular country this is the regular outsourcing phenomena that happened in the vertical SBI so the basic difference between the two is the horizontal integration always occurs at the same stage in the supply chain in other words if you were manufacturing something in Japan you will come and do the same manufacturing process but the same manufacturing this one in India but on the other hand in a vertical integration always occurs in the stages of the supply chain what are the stages list the suppliers that is the bank components auto components the assemblers the assembler the assemble things their logistics providers they move the material from one company to another Shore.

So basically the vertical integration or vertical globalization is the one that is happening nowadays and it is much more interesting to study the various optimization and performance studies in vertical globalization.

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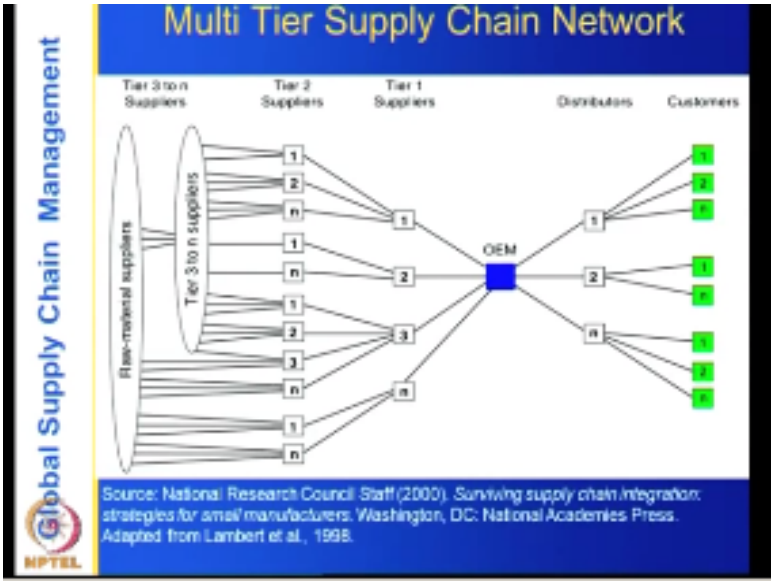

This particular slide is an important slide because it shows you what is called a multi -tier supply chain network we have a volume where the manufacturer and he orders he assembles the product from several sub assemblies one two three four one two yen and each of these sub assemblies manufacturers require some components and they get it from tired two suppliers and

each of the title suppliers they require components and materials they get it from type three to n suppliers and finally this apply to any ends with the raw material suppliers.

So there are several levels of the supply chain here but usually people the manufacturers worry about tire one suppliers thinking that tire one suppliers will worry about tile two and type three and so on but one should remember that even if tire 3 supplier was located in some place like Bangladesh or in Japan and if there is a tsunami there that affects entire supply chain so this is called that is why it is important to map the multi three-year supply chain where all your all your players are there supposing a supplier in one of the countries is his bank fails so he cannot supply the products.

Because he does not have he does not have funds so then the supply chain also gets affected so it is important to monitor the economic physical and other another and other environmental effectors of all your suppliers and have a map of all this some kind of a an excel sheet where all your players which you are supplying to you or and their locations and their addresses their banks are all known to you so here supposing you are a manufacturer who manufacture dolls like a Barbie doll or something it is very important the Barbie doll which is used by the children they it has the it has the safety features.

So supposing they use the paint on the Barbie doll to show the color and the paint has led content in it if the lead content is more than if the jail leaks the paint and puts it if the Barbie doll in the mouth then it could be poisonous so there are several accidents like this that have happened in the future so it is important that the multi-tier supply chain is mapped well and of course within the forward direction you have the distributors and finally the customers through the retailers so this is the this is an important diagram. For supply chain supply chain researchers.

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So once we have this kind of introduction to the to the supply chain Network and I have shown you several examples in the agricultural in the industry in the Globo this one has shown you the three examples, and I have also told you that we have a multi or supply chain it is not one player it is several players which are companies and these companies are independent players in other words if there is a supplier of auto components is located in Japan and if your manufacturer is in is in India then there has to be a have to collaborate but the magnetic supplier has no basically binding relationship with the manufacturer there could be contracts and it has to be a contractual relationship.

And so on so when you are studying the suppliers and it is a kind of a social network the supply chain network is a kind of social network but the social network is not persons usually Face book and other social networks are between persons but it is not persons here it is organizations independent organizations which are globally separated and located in different countries with different cultures so how do you integrate such a supply chain network and if you look at the previous diagrams.

There are three flows that happen in a supply chain Network first one is Goods flow that is the material flow it goes from suppliers to the manufacturers a components flow and from the manufacturer to the distributors the final products flow from the distributors to the retailers the customized products flow and finally to the customers so there is the goods flow involved in the supply chain and second one that is important that a note is the information flow so we have the

information flowing exchanged between all the partners either through faxes or through internet or through telephone calls or through videos.

Whatever there is an information exchange that happens among all the players in the supply chain and the third one and the most important one is the finance because unless money is paid nothing moves so this finance you try financial transactions among companies usually happens through banks or financial institutions so let us look at how these three flows are integrated in the supply chain networks.

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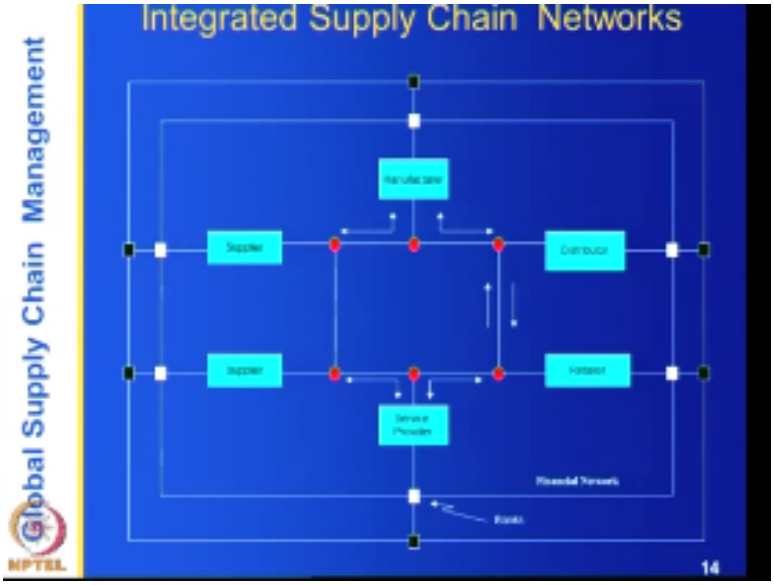

So you have these players in the supply chain network that is the suppliers you have manufacturers and you have distributors and retailers and you have service providers the service providers could be basically logistics providers who provide for the transport like truck owners or it could be trained or it could be ships whatever so you have all these players and all these players are all globally distributed they are not specially co-located they are all at various places over the globe and the next thing that happens is because the goods need to move from one player to the other in other words from suppliers.

To the manufacturers and manufacturers to distributors distributor to the retailers and also to the service providers and so and so it is important you have a network and this network is called the logistics network and the red dots that. I am showing here the red dots these are called hubs

you know there are places like for example in India it is Bombay or Chennai or it could be Singapore Hong Kong Notre dame these are all some these are all ports or supply hubs or there could be air hubs or it could be train hubs for example India they are building Nagpur as a hub between the various places so there is a well-developed network with the multimodal transportation between the suppliers manufacturers distributors and so on so that is a logistics network the next one that comes in is the information network.

And then this is the web 2.0 that were either they are all connected to the suppliers are all connected to through various means informational II connected so basically with the supplier needs to transcend an information or the manufacturer has to send an information either the product or the financial information he could do so immediately using this one these are all secure transactions over the web and finally there is a web connectivity among the bands of the sublease various players in other words money transfer can happen and so and it is very important that the finance.

Banks are connected because the supplier when before he just gives okay to ship the products to the manufacturer he needs to have a money guarantee in other words he may not have all the money that paid to him before he ships but then the manufacturer receives the particular shipment then the supplier needs to get paid now what is the assurance he gets the assurance from his back his bank gets assurance from the manufacturers back these are called letter of credits. So the these kind of financial transactions and also insurance transactions had to happen in the supply chain and that happens through the financial network.

And so if you once you have this network you can divide this integrated supply chain into three sub networks the first one is what we call a demand Network the demand network is basically depending on the customer demand that you have the customer demand always occurs through the retailers and the retailers are going to order depending on what their requirements are from the distributors and the distributors means they have a warehouse where these particular items are stored and the second one is what we call supply network where you have the suppliers supplying to the manufacturer and this particular network depending on.

The manufacturers requirement the supplier supply and then there is logistics that is associated with it is called b2b logistics or business-to-business logistics and the logistics that is involved in the manufacturer - distributor to retailer is called b2c logistics and finally the third network

which is also very important network which basically connects the suppliers retailers manufacturers and others it is the service providers these could be service centers as I said in the previous slide in a previous slide this can be repair centers where or it where the suppliers supply the spare parts for the repair of the particular products of the customer.

So you have this network and then the three sub networks for this now this diagram is an important diagram here because it shows that the connectivity the between the various players in the supply chain network you have the three kinds of players here the one is the manufacturers the distributors retailers the suppliers and the service providers and the financial service providers and also the IT the information and communication networks and so on.

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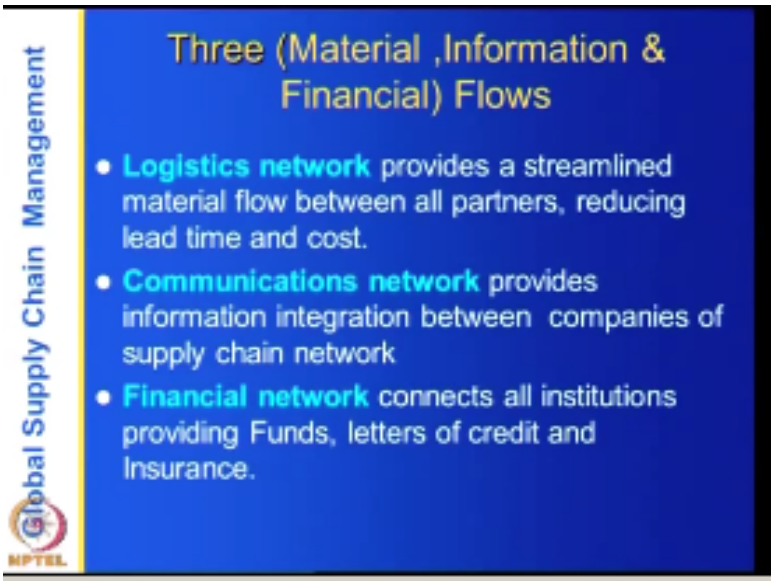

So the next slide will see the will analyze this particular diagram there are three flows as I said they finally the first flow is the goods flow or the material flow between all the partners now the logistics network provides a streamlined material flow between all the partners. It is very important that this the time that is taken to supply this is low and I did also recast because if the time is high that is then the manufacturer nee has to need the key has to keep what is called safety inventory so because of that what do you need to do is your logistics networks has to be streamlined and the lead times.

Has to be reduced and the lead time is reduced that means the quality is high as well as the cost is low the second network is the communication network as I said it provides information

integration between the companies in the supply chain Network and this information that is transmitted could be the order ordering , process or it could be an information regarding the status or it could be the information regarding the requirements and so on so it becomes or it can be information regarding the funds flow and finally the financial network it connects all the institutions providing the funds letters of credit insurance.

And so on so basically these are the three sub flows that happen the end these are the three networks that facilitate the flow of the goods the information and the finance.

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This and their three sub networks as I said one is the demands of network it has manufacturing distribution retail logistics finance and here what it is what is called perfect delivery perfect delivery is what is called 6Σ delivery 6 Σ is if the customer makes an order and there could be several things which can make him unhappy first one is the prod there could be a defective product or in a product could be delivered late or it could be there are several other kinds of things that can happen with this that could be delivered to the wrong person and so on so what is important is the perfect delivery which is called 6.

That means the defect should be > 1 and million the second one is supply chain sub network where it is a business-to-business network with the suppliers manufacturers and their what are called inbound logistics players financial institutions frightful waters and so on this is a huge network that is because the material that flows between companies is you know it is an orderly

flow it is a huge flow it has lot of financial implications in this because the flow has to be at the right time at the right place and it depends lady your production times and the production capability depends on this particular sub Network and finally.

You have the service of network which connects consumers with suppliers and manufacturers after sale service centers and so on so basically the three sub networks. Which I have shown earlier that is the demands of network the supply sub Network and the service network are the three features of this particular supply chain network.

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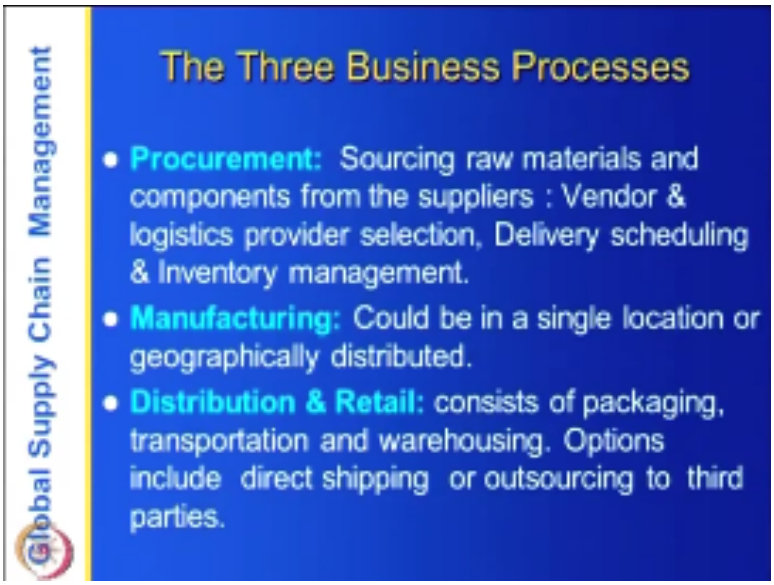

And if you talking of what are called processes business processes there are three business processes in this and the first one is procurement is sourcing raw materials and components from suppliers see it is a vendor and logistics provider selection delivery scheduling and inventory management these are all the issues associated with procurement and procurement is an important business process for any manufacturer. Because if you do not select the right suppliers the right logistics players and your deliveries could be delayed which means that your production gets delayed?

And that means your customers will be unhappy and so on so you have to keep lot of inventories if your vendors and justice providers are not good so the selection of the vendors and the sourcing of raw materials it is not always the cost considerations that matter in the procurement it is what is called total landed cost it is the cost that taxes you pay if you are

importing it is the logistics players that you pay it is the coordination cost that you pay and the several costs that are associated with the procurement and one has to be carefully select these partners.

And this second one business processes manufacturing this manufacturing could be in a single location or it could be geographically distributed it means that you have basically companies like flex atonics they have a factory in Chennai the manufacture cell phones or the manufacturer various other things like laptops or so on but they are all it could be in single location or it could be a multi plant location in other words part of the product is done in one location and it is shipped to the other location and so on so this kind of thing happens in apples for example the in the apparel industry.

We will see this particular example in more detail in the later lectures of this course and finally to the distribution and retail in other words the customer reserved through the retailers and the retailers are sold through distributors and distributors get their products from manufacturers so it consists of packaging transportation warehousing and sometimes the manufacturer can directly ship to the retailers or it can outsource the third party and so on so basically whatever happens in the supply chain but as we saw in the multi tier supply chain diagram.

There are three processes of procurement manufacturing distribution and retail the three business processes here.

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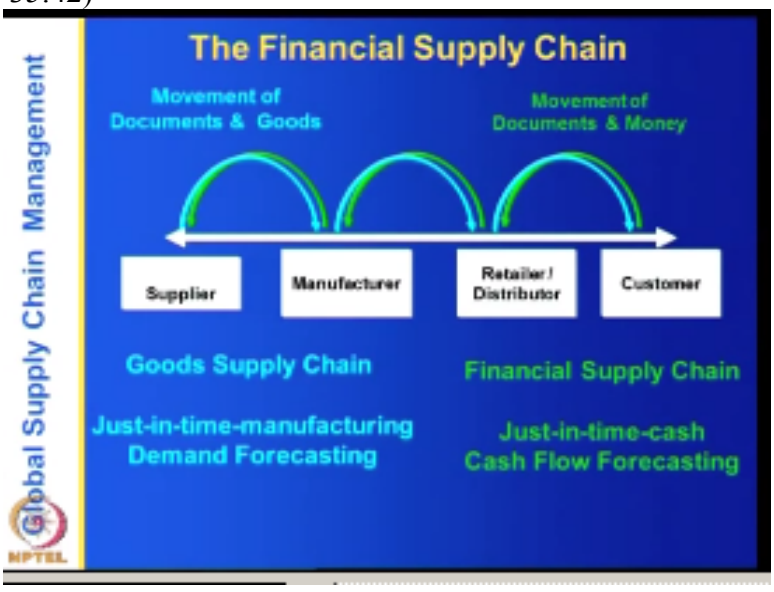

Now let us look at the finance supply chain here what happens is that you have basically these four or five players that is the suppliers manufacturers retailers and distributors the material flows from supplier through the customer in other words as the material flows it value is added to the particular product that is the supplier to manufacturer to the retailer and retailer to the customer and but what happens to the finances so the movements of documents and goods happen in a forward direction so there are things like demand forecasting. How much they how many how much of the products the customers want and so on and also there is what is called just-in-time manufacturing.

Where you do not want to keep any inventory if you keep inventory costs money so if you want to reduce the your cost then it is necessary that you keep as much less inventory as possible but if you do not keep inventory then you are basically your production or your supply chain can be disrupted if there is any problem that says some well supposing some machine failures some prick failures on the road these kind of disruptions can affect your supply chain so some amount of inventory is needed.

But too much of inventory means too much of too much of money inside and also there's a lot of Absolution costs and the other hand the financial supply chain goes in the reverse direction you know it is the supplier who puts the money first but when does he get the money back he gets back after three months but the retailer gets the sells to the customer , he gets the money first and it most backward retailer to manufacturer and manufacturer to the suppliers and so on so the cash flow forecasting becomes very important in the financial supply chain.

So it is important to do see that the goods more move in one direction forward direction and the financial finance the funds move in a backward direction less.

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So we have seen so far that we have the integrated supply chain in the integrator supply chain we have three flows the goods the information and the finances we have three business processes we have three new sub networks and so on once we have seen all this but how many players are there inside the supply chain if you are looking at a 30,000 feet view of a supply chain looking from this you have suppliers and how many suppliers they are scattered all over the world and depending on that if you take auto manufacturers there could be four to five thousand suppliers and their logistics players.

Which are business to business or business to customer kind of suppliers business to business is large amounts of goods are transferred that is between suppliers and manufacturers and so on business to customer it is small amount of goods are transferred because the customer orders are always less in quantity compared to the factory orders so their logistics players how many logistics players because each supplier when he supplies to manufacturer from his own country he has his own logistics players so there is several logistics players from each country.

In this their contract manufacturers who basically supply the sub assemblies or sometimes the final products the original equipment manufacturers they are the ones who supply the decides they select the suppliers they basically schedule the entire delivery of the particular product end to end and they're one the brand that their brand is the one that is if there is any problem they are the ones who get the badly and finally there are distributors and the retailers so, I mean

if you take any particular supply chain like automobile or even the electronic supply chains they are basically thousands of players.

But you can group them as six dominant players this and these are all independent companies and they are globally distributed and they are all highly connected now this connection is becomes very important if you are sourcing, if you are a manufacturer in India and if you want to source from China how do you know about the suppliers in China what is their quality what are the banks this one what is their financial status and what is the record of this so that is where this networking becomes an important issue on this so in the next slide.

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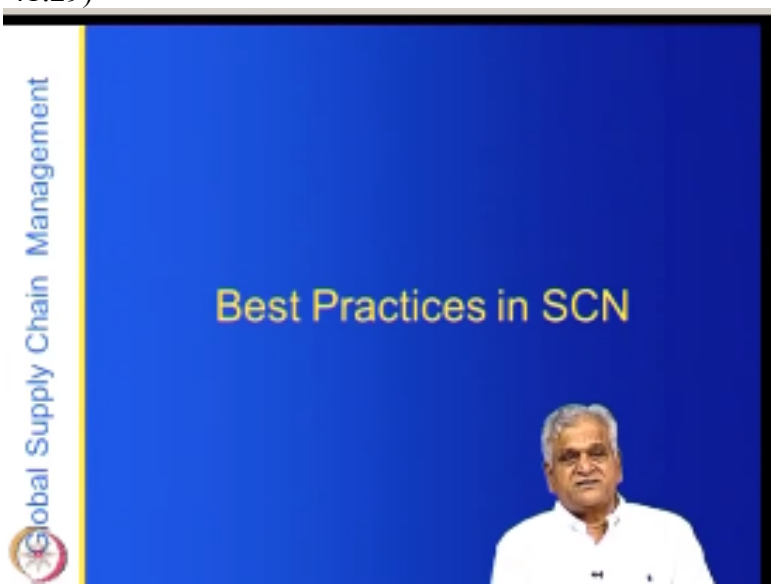

What we will show is the best practices in the in the supply chain Network. So before we get into this the best practices let us review what we have done what we have done we started with the definition of a supply chain Network and we said supply chain network is a very important thing because we had every product or a service there is a network and if your product has to be good your network has to be good and if you want to know more about your product you should know where it is coming from and how it is going to go is coming to you and what are the routes it is going to is it this following and we said it is we define the integrated.

The supply chain Network and in the integrated we also analyzed the business processes the sub networks and the flows and so on so this higher level view of the supply chain is useful in the future when we are talking about global supply chain management so if you look at the

supply chain networks what are the best practices in this so I list the some of the best practices here.

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The first one is what we call supply chain now we said that the supply chain network is globally distributed supposing there is a manufacturer who assembles a particular product and the manufacturer gets various components and sub assemblies from all over.

The world now there are uncertainties in terms of transportation there are uncertainties in terms of weather patterns there are uncertainties in terms of the political scenarios of various countries and so on so what people want is the certainty if Dell says it takes the money from a customer and it says I want to deliver within 48 hours a laptop to the customer who is located in Bangalore then it has to keep its promise but if it is if it has to do that then it has to maintain the inventory nearer to the factory.

So at the manufacturers site some third party maintains inventory for the suppliers at the manufacturing site in other words once the manufacturer gets an order from the customer then he is going to basically order the components from the supply hub which is located very closely to the manufacturing site so who maintains this inventory because inventory costs money the suppliers so this is called supplier bond inventory and the supply hubs are very common in the electronics industry as well as also in construction industry because if you are building an airport or building a big construction house.

Then the all the players are going to put all the building materials the this event or all the electric equipment and all that nearer to the place so that you know no delays in the supply and also there is the reliability of the supply of the particular components and the second one is what we call modularization. Now there are two kinds of products one are integrated products the other words the product is made as designed and made as an integrated whole in other words if one part of the product goes then the product would not function but on the other hand if the product is designed as component modules.

And each module can be used as multiple products in other words so then if the product goes wrong then you can throw it out and then replace it by another product it is basically salts in repair and also if you want to if people want multiple products with multiple designs say, if you want to have a hard drive from terabyte to gigabytes to this one then you can depend on the customer order and customer financial status you can basically have the corresponding hard drives so this similar this modular addition of component modules that can that helps in the basically flexibility it gives the flexibility.

To serve the customers the third one is what we call standardization so there are some parts and these parts are standardized so that they can be used in multiple products and multiple models so standardization of processes standardization of products is an important aspect when you are darling dealing with global this one and finally there what is called cross docking cross docking is it when but components are coming from suppliers to the manufacturer and there several suppliers were supplying at various from various places in the world then they all come together at one place at one nodal point.

It is called transshipment a place and where the goods are sorted consolidated and loaded into the outbound trucks and this transshipment hubs or for example Singapore is a transshipment hub in the shipping where you can unit supposing you want to the ship's come and unload their containers from India from Australia or from Colombo and all other places and whatever is bound to Europe , it is put on ships on the Europe whatever is bound to us this is put on the ships of you are us and so on so basically the Strand shipment facilities are the ones where the goods are sorted I mean there are several sentiment ports.

Which are become famous Dubai Singapore Hong Kong and so on so these are called cross dockings cross docking avoids what is called inventory otherwise what you have to do you have to take these products and keep them in keep them in the warehouse and do the again loading.

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And unloading and so on so the next one is what we call postponement. So final assembly done adding customer specific features such as labeling and packaging for customer manuals and so on so the final product is made after the customer orders finally merchants transit is components are shipped from different production units and warehouses are assembled during transit so this is done at the airports which is a very nice way of doing and finally.

There is a collaborative planning forecasting under placement where the collaborative intelligence of multiple trading partners in planning and fulfillment of customer demands so you have basically various collaborative between multiple trading partners and the whole forecasting everything is done using that ,so what we will do is I will repeat these two slides in the next class and we will take it from there so - to summarize what we have been doing so far is from starting from the definition of his obliging Network we have seen examples of various kinds of supply chains like from agriculture to industry from global supply chains.

And so on and we have seen their importance and we have mapped for the integrated supply chain and that supply chain has we have disintegrated the supply chain for this purpose of study into various business processes , various sub networks, various flows ,and so on so basically

that helps us for further studies and we have seen the best practices the seven best practices in a renewable supply chain in the next class we will take it from there and develop the theory of global supply chains thank you have a good day you.

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