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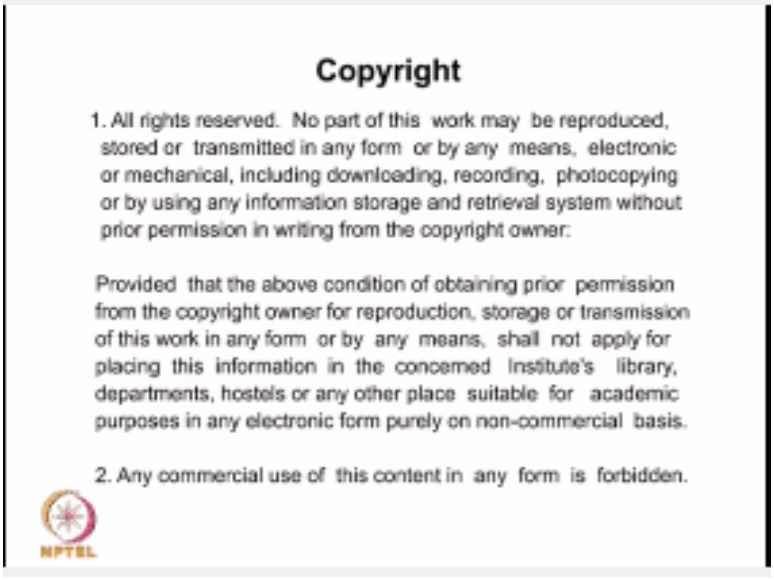

Global Supply Chain Management

Lecture-08
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So far we have seen the four elements of the supply chain ecosystem for a global supply chain now one of the important aspects of the analysis is the performance analysis of the supply chains so it is important how each of these four elements contributes towards the performance of the supply chain you know for example the performance means we are looking at lead time cost and so on how does we give in a supply chain and the factors how does the institutions that if the government policies in various countries where the suppliers are the assemblers and the logistics providers are located or and also the delivery this one we the roads the infrastructure and the third party logistics providers and the resources there expensiveness we all contribute towards the performance.

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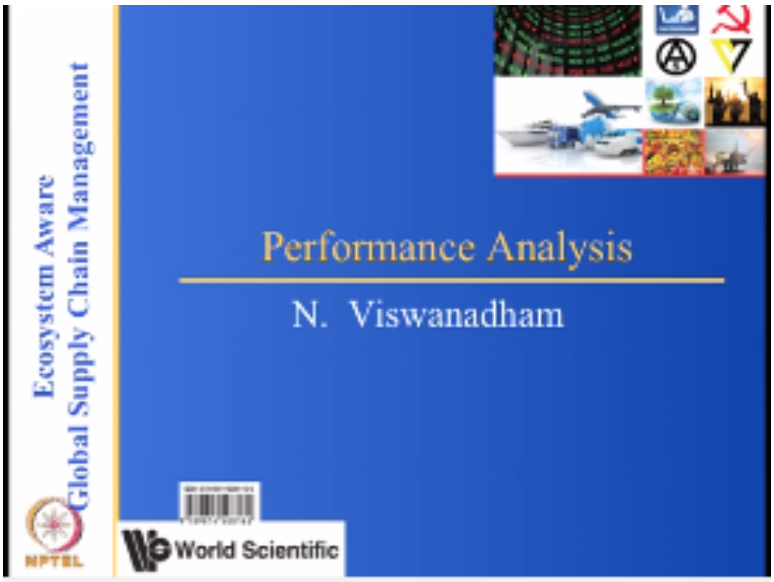

So this is where this becomes an important part of the ecosystem and augment so when say what is the global supply chain performance will we will first mention the elements.

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And then look at the leak type and then the cost and look at the performance measures and the ecosystem now as I told you before that the ecosystem the four elements have several decision-makers in other words if you take the institution the government is a shunt maker if you want

to change the policies to make this applied to so to make the institutions more favorable towards the supply chain performance and similarly if you are looking at the resources of looking at their delivery infrastructure there the corresponding nation makers had need to be responsible for the supply chain performance so that is where the performance measures on the ecosystem is an important thing.

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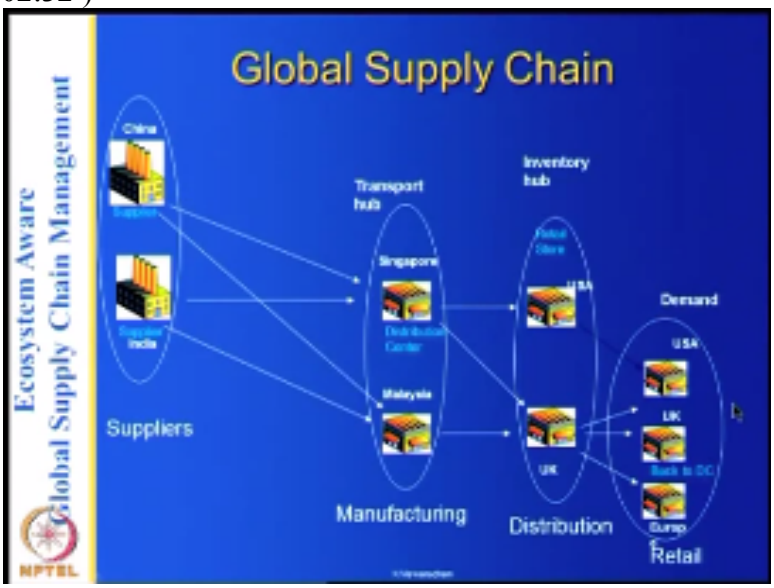

Hello this is the global supply chain which we have where the important thing is the suppliers are in and countries like China and India which forms the tail end of the supply chain whereas they demand or the retailers are in the US ,UK and so on so basically the intermediaries likely the transport hubs the manufacturing and distribution everything is in between these two countries so the goods travel as we have seen from the tail end of the supply chain to the head of the supply chain where the demand is there.

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So what are the performance measures that we have one of the performance measures is deleted what is later the definition of lead time have any process is in the interval between the start and end of the process.

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So now here if you take a supply chain they are variously terms that are involved if you take the entire supply chain it is from the start of the manufacture from the suppliers from there are materials till the product is delivered to the customer so if you take the if we make an automobile the entire lead time could be from the mining of the iron ore till the end the car is

finally delivered to the customers by the dealers this is where Henry Ford used to say he want to mind.

On a Monday morning and then deliver the car which is made out of the same steel on Thursday evening and collect the money on Friday morning so this is the kind of vision that Henry Ford has that because his company was vertically integrated has warned iron mines to the ships to the factories to make the cars and so on so but once he sells it to the dealership he collected the money so he was basically saying that he is four or five days he is the lead time.

That the interval from there between the start and end of the process but nowadays it is with a globally dispersed this one you have the this is the supply chain lead type you can have the lead time between the manufacturers on the distributors now for example if what Dell does is if you pay the by dell today and I will say they will deliver you within 24 hours the order goes to a manufacturing assembles the PC and it is given to an Express service provider.

And it is delivered to your house so that is that that is the lead time but it is not the entirely time it is the delivery time to assembly and the delivery time for transporting it to the customer but whatever is the time you have to define the appropriate time interval between the two they start and business of the processes which where you want to minimize the leader reducing the lead time basically phrase resources reduces the cost and improves quality why does production and quality lead time improve the quality.

That is because if you are doing everything going well and you are able to assemble the products correctly that means you have high quality products with you and the final assembled product is of high quality and it also frees resources instead of taking two hours if you finish it in one hour then you have this all you have all the resources which are freed for one hour and similarly you are reducing the cost because of its factors now what about the cost now in a global supply chain there various costs that are involved that is of course the unit cost the cost of material and the product there are costs involved in transportation and storage because the components have to travel from the supplier to the to the assembler and there in between.
There could be in some warehouse and it has to be definitely transported by trucks and ships and so on so there is cost involved there and also the customs there if the insurance because when the products travel there is necessarily in periods there are financial services financial the banks provide the financial services but they are net free but they have their own margins and

there are negotiations there are people who are talking to the banks to do the business for you they are talking to the insurance to do the business.

They are Talking to the customers for facilitating the transport of goods easily so always basically these negotiations negotiations are expensive and also inspection damage theft of solutions etc if you are not able to sell the product and it becomes obsolete then you have to throw it away so basically epsilon sees another cost strategies for cost reduction deduction are important so what does the late time and cost are important in the sense if you have a product you should sell it to the customer immediately otherwise you have all kinds of cars now depending on where your customer is you inquire lot of other cars like transport customs the insurance and so on so basically one has to be carefully measure or carefully understand the implications of lead type and cost.

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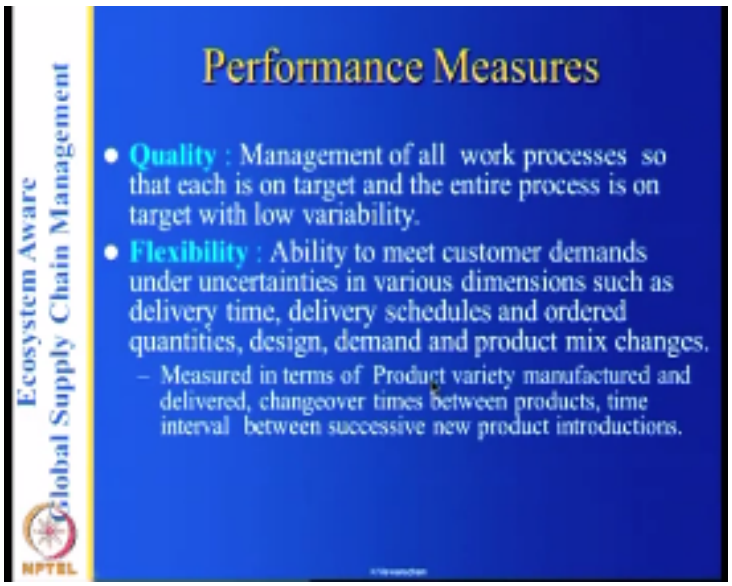

There are other fair imagine one is important thing is quality managing all the work processes so that each is on target an entire process is on target low variability basically if you say this particular product they should take only one week and it should be next week it should be delivered for whatever reasons all the work processes should be so that should be on target seen that to be a target so that the entire process has less variability.

Variability induces other uncertainties and notable improve the entry the inventory levels another thing is the flexibility of the supply chain it is the ability to meet customer demands

under kind of under uncertainties of various dimensions for example delivery time somebody may want it in 24 hours 48 hours next week and so on delivery schedules and ordered quantities somebody may say a small shipments.

So he wants return a Monday morning or he wants several shipments of small quantities design demand and product mix changes so those are the kinds of things that different customers might measure depending on their convenience ask from the manufacturers so you should be able to provide flexibility for all this is usually measured in terms of product variety manufactured and delivered changeover times between products.

Time interval between the successive new product introductions so this delivery the flexibility is an important issue but the supply chain sometimes may not be able to this one but it meet all the requirements it may have a menu of items for example companies like Dell they produce species of various quantities but they have a menu they have a sheet based on which you can Order and you will be delivered a menu from which you can choose but some companies may have more flexibility in terms of this but it is important to note that the flexibility costs much more flexibility means more work more coordination and all that.

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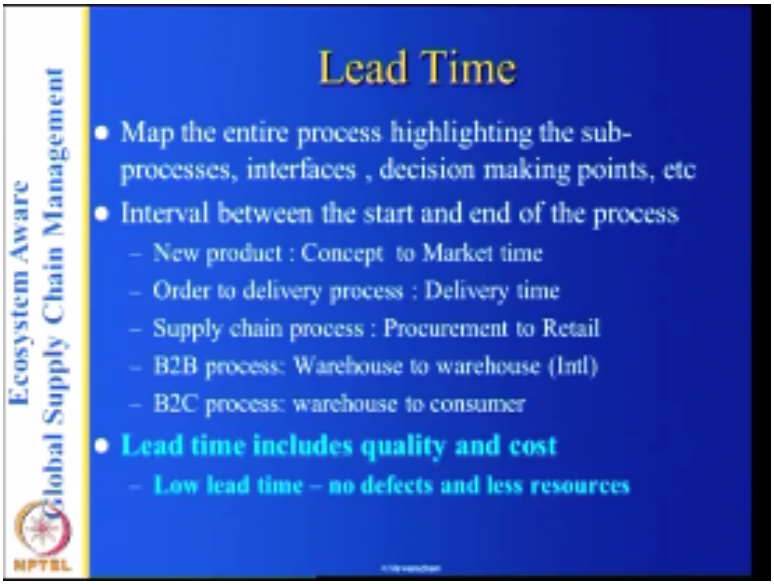

But in this lecture we are going to look at only two first two or three of the performance measures one is the lead time and the other one is it cost so then the other things we will leave it on the reader to figure out so what is leader anytime is you map the entire process

highlighting the sub processes interfaces diction makings points etcetera you know what happens here you have you have the supply chain you have suppliers manufacturing and then from suppliers to their transporting the goods from supplier to manufacturers.

And so on and you have a supplier the logistics provider and the manufacturer and there is an interface between the supplier and the logistics provider and the logistics provider and the this one this interface means it is basically a coordination issue so this interface is smooth everything is fine then the lead times are low if the interface are rough in other words one does not talk to each other or they there are misunderstandings.

About the delivery and other things and they may say I just want to eat properly then there could be late time should be higher and also there are decision-making points at each level now for example if I say the berries shipment is ready but somebody has to say you will take the shipment and deliver it to somebody so they station making points things have to be has to be carefully this one they also determine they delays that are involved so the interval between the start and end of a process it depends on the context.

For example if it is new product the lead time is concept of market time in other words only time we will decided to produce this particular product to the time it is in the market for the use by the customers there is what is called order to delivery process for example in case of Dell and others is the delivery time in other words once you receive the order if it is a new in warehouse you supply it immediately it is not in the warehouse you assemble it and supplied so if it is you have to manufacture then from order like furniture you once you get the design you manufacture it then assemble the whole thing and deliberate so the delivery time depends.

On the order to delivery and so on the supply chain process it is a procurement to retail and if it is b2b process it has warehouse to warehouse it is b2c process it can be very house to consumer so the point I am making here is that you have to be carefully define your process and its beginning and the yet and also who are the people who are involved and what are the interfaces what are The addition making points then it is easy to get the little lead time includes quality and cost low lead time that means no defects and less resources so any cost is less if you have more time more lead time that means more you are using more resources it means more cost.

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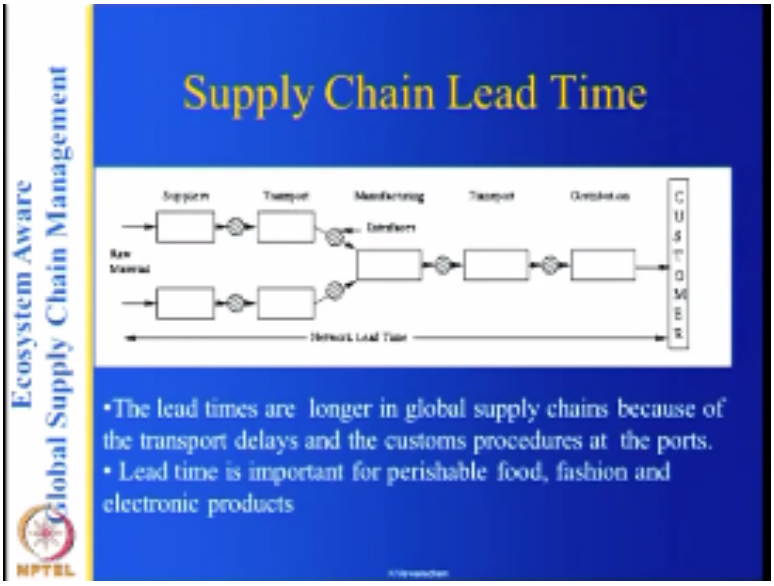

So if you look at the supply chain lead time the lead times are longer in global supply chains because of the transport delays and customs procedures and the ports anytime is important for vegetable goods supposing you take this particular diagram from the raw material there are the suppliers and these are interfaces between the supplier and the transport and these are the interfaces between the transport and the manufacturers and then to the distribution.

And to the retailer throaty customer and so on so if you are talking of the network lead time they say they network like that now there are the suppliers their manufacturing time and their loading times here and they logistics this one and of course this is the transport time and this is the manufacturing assembly type and again transport time and distribution time and I take your place their audition makers and their addition making time.

And what we are all there is a coordinator and their squad data eight-ball becomes this one so it is basically if you have a global supply chain compared to a local supply chain where from the supplier it goes directly to the manufacturer without this transport if it does not cross countries then of course it is simpler you are you are skipping the customs the ports and so on so basically the late times or shorter lead time is an important if you are talking of food fashion and electronic products.

Well the technology changes in electronics or is very fast so they are there for example as I you can see that maybe there were pc is from pieces we have laptops from laptop to tablets to cell phones so the technology is changing very fast so because of that we have here an electronic

product is like six months to deliver then the product is outdated by the time it is delivered and similarly food is time-sensitive it has to be temperature sensitive so if you are 2-4 did I tell you what after 2 days then it becomes spoiled and similarly fashion fashion clothes so fashions change so you have to deliver them first within weeks so the supply chain lead time it all depends here if you are if you have it in the distribution center then over to the customer that is the delivery time here but on the other hand if you are assembling on transporting and it is it. Is 2-butene this is the lead time but if you are starting here and that becomes the supply chain Network lead time so they lead time difference so but it is important to note that lead time is a very very important measure and one has to carefully measure and minimize.

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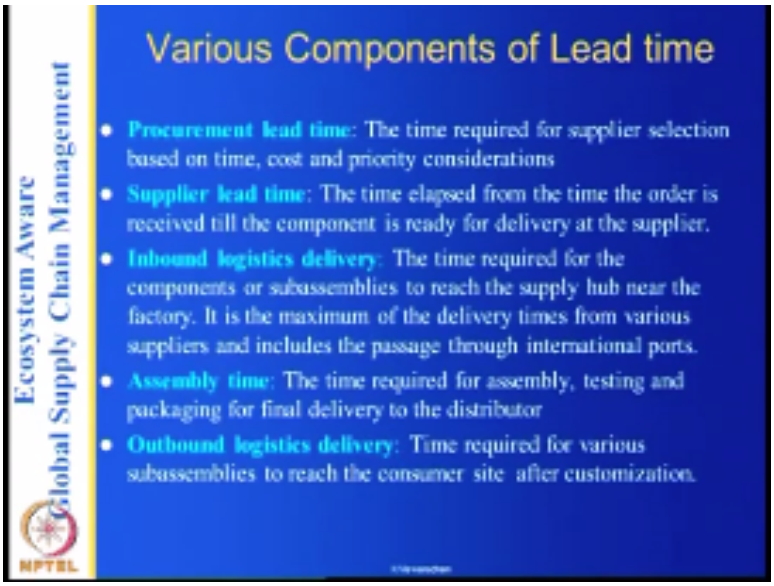

The leader so you want to get the components of this what are the components of the leak that one is procurement leader that is the time that is required for the supplier selection based on time cost and priority considerations so if you have a particular product you want a Isamu you have to basically choose the suppliers and the supplier once you he receives the order he has to manufacture and deliver it to you and through a logistics provider.

So it was both the logistics time and a delivery time as well as the manufacturing time in addition to the selection the supplier selection and other priorities so it depends on the suppliers capacity to deliver things on time because it misses manufacturing capability and capacity

should be consistent with your order the second time is the supply of leader the time elapsed from the time the order is received then the component is ready for delivery at the supplier.

And then the inbound logistics the time required for the components or sub assemblies to reach the supply hub near the factory is the maximum of the delivery times from various suppliers and includes the process through international ports so if you if you are a manufacturer and you are maintaining a supply hub before your factory then you have several suppliers located in different countries and all of them all the components need to arrive for you to dissemble so that is where the maximum they time the delivery times are the maximum of all the delivery.

Times supposing one component one comes in one week component two comes in three days component three comes in two weeks so although the other two have come one and two have come earlier the component three takes priority because you can though they assembly were too big so other things have to wait on this so if you take the maximum of delivery times from area suppliers and includes the process to international there is the assembly time assembly time if time required for assembly testing packaging and final delivery to the distributors but of course outbound logistics the time that is required for various of assemblies to reach the consumer side after customization so this is already the five components of the lead time.

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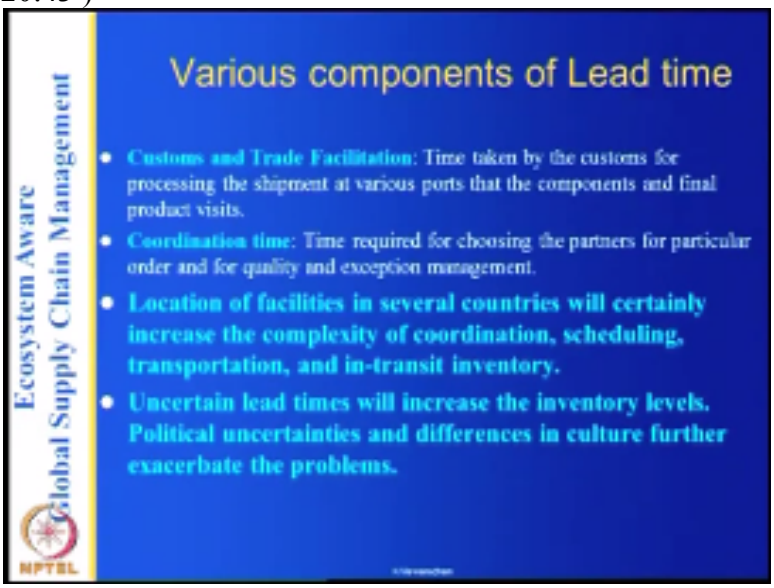

Other two components are the customs and trade facilitation I am taken by the customs for the processing the shipment at various ports that the components and final product visits and there

is of course the coordination time required for choosing the partners for a particular order and quantity quality and exception management well these are basically the seven components of the time and you have to add all this to complete location.

So when you are basically if want to minimize the time location of facilities in several countries will certainly increase the complexity of coordination scheduling transportation and in transit inventory and then there is no doubt that global supply chains are more longer and they have to carry more inventory than the local supply chains so if you if you are looking for the cost advantages of the global versus this one the low cost advantage may disappear uncertainly times will increase the inventory levels political uncertainties and differences in culture further accelerate problems.

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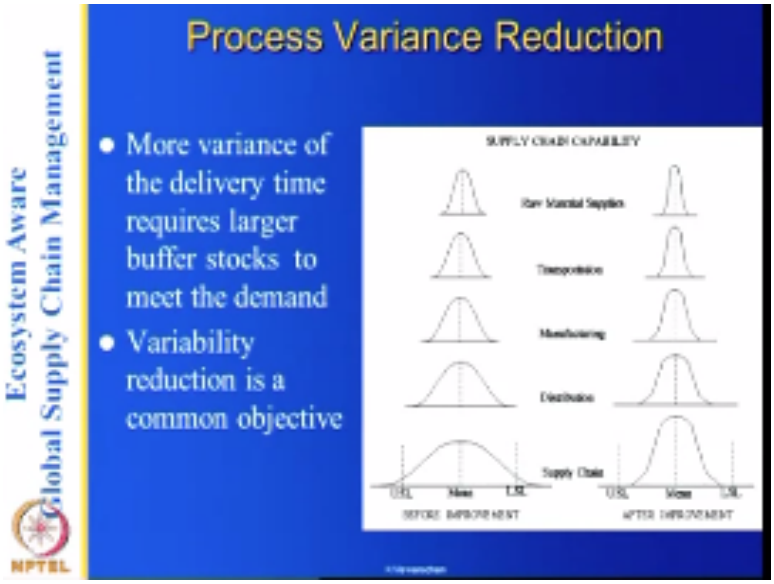

So if you have take the raw material suppliers transportation manufacturing distribution and if you assume everything is normal then you can write the supply chain capability of supply chain leaf types and you can find out the finding limits LSL and USL and if they are not within the limits you can always try to improve the supply chain capability more variants of delivery time and requires longer buffer stocks to meet the demand variability reduction is a common objective so in the supply chain late times.

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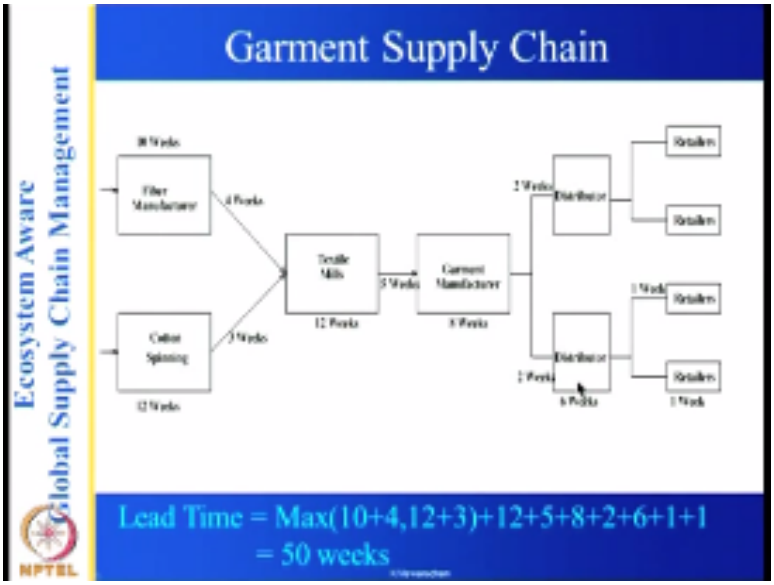

So if you take for example a garment supply chain like example you have the fiber manufacturer who is takes ten weeks and you have cotton spinning which is takes 12 weeks and the transportation takes four weeks and here transportation three weeks so which actually means that this is the maximum of 10 plus 4 and 12 plus 3 which is 15 and this textile mills take 12 days 12 weeks and garment manufacturer takes 8 weeks and there is five weeks of transportation time.

And there are two weeks two weeks of the transportation time to the distributors and distributor takes six weeks and there is one week to the retailers so you take actually delete and the lead time becomes 50 weeks yes so what you can see is here in the garment supply chain if you just leave it to the itself the supply chain then it takes almost like 50 weeks which is large like one year from end to end and the garments or fashion intensive.

So if people retailer here who is a big retailer say in the US he has to order one week before one year before for making the orders that becomes a big issue in terms of management of various factors but if you take some of the more recent orchestrators likely and former something they take only six weeks from me and two yet so if you can coordinate well you can reduce this fifty weeks to almost like six to eight weeks so that basically depends on the same but it depends on the architecture and the governance mechanisms that you use to reduce your supply chain and also the coordination costs.

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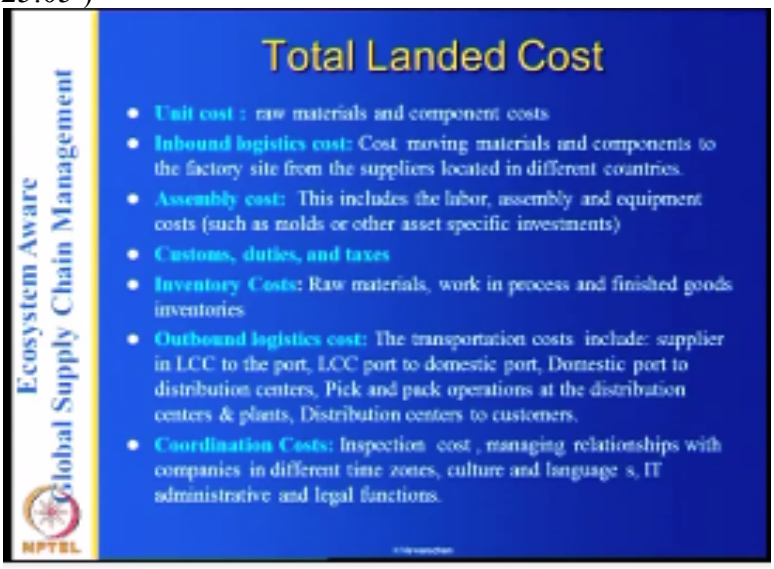

So let us look at the cost here so what is the total landed cost that is in what thus the total landed cost is the unit cost that is the raw materials and the component cost and inbound logistics cost of moving materials and components to the factory site and from suppliers located in different countries and the third one is the assembly cost this includes lever assembly and equipment costs such as molds and other a such specific instruments.

But of course there are the customs duties and taxes and their inventory costs raw materials work in process finished would in turn two inventories an outbound logistics cars a transportation cost includes supplier to low-cost country port LCC port to domestic port no mistake port to distribution centers we can pack operations and the distribution centers and plants and distribution center to the customers so basically.

You have is six components of the costs you can include the brokerage and other cause if you want to coordination costs which are the inspection cost managing the relationships with the companies in different time zones culture and languages IT administrative and legal functions so it is not just the unit cost we usually people take all day cheaper if you hurt if you take the just the unit cost but what about all this the transportation costs coordination cars there are the inventory costs and customs duties and others and so on so one has to carefully SS when you are doing a global supply chain when you dealing with a global supply chain you have to carefully assess the total landed cost.

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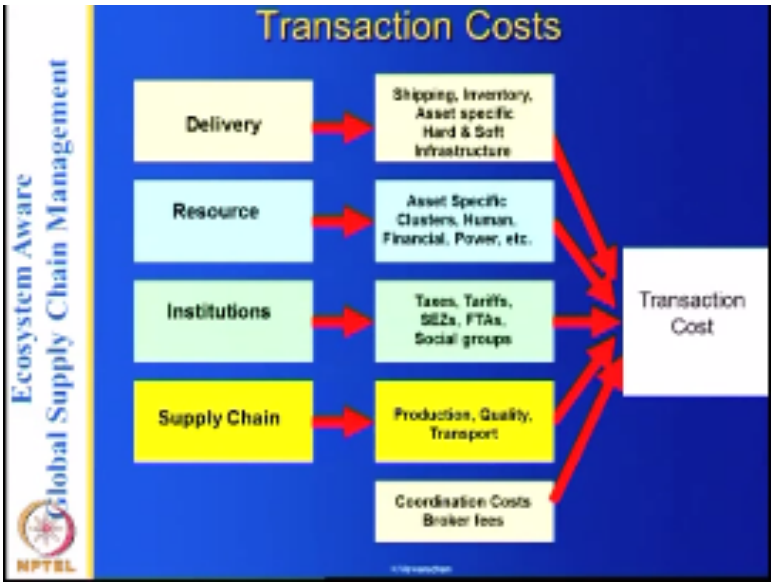

In this so if you look at the transport cost a transaction costs which are there and that is the supply chain which is the production quality and transport cost that is belong to the supply chain and you had the delivery because deliver a shipping inventory is a set specific or and soft infrastructure here I have used the word asset specific and such specificity depends on the particular component that you are involved in other words if supposing you are transporting.

The equipment like boilers which is a huge equipment for oil and gas furnaces or something then these are made in one country and I have need to be transported to the other country of course by ships but these have to be dismantled first and they have to prove it because they do not go into the ship and they cannot come under truck so they have to be dismantled their view requires special equipment special trucks to load them.

Onto this and then you have to be basically assemble at the other end of this so basically shipping is not just taking the components like if it is a PC you just pack it put it in a box and then put it into the container or into the aircraft and something but there are the transport could be highly asset specific if you are transporting a car for example you had to have a special truck for that and the special truck has to come empty well while coming back from the delivery.

Of the particular car supposing in India if the car market Maruti cars come from somewhere in Delhi to the south then after coming back these huge trucks which are used only for delivering cars they have to go back empty so that is where the delivery mechanisms become

highly a tacit specific but also there is the hard and soft infrastructure that is needed in the delivery mechanisms that is because it is not always the trucks you have to basically.

Carry they carry the documents you have to also carry the insurance and other issues so the logistics companies are the delivery this one has to have yeah there could be highly asset specific equipment you may need and also depending on the insurance and others you need to have coordination with others lives in this then there are resources for example depending on the particular product you are doing unit good resources could be assessed specific.

At a the clusters you may require Human Resources who are basically if you are in R&D you require PhD is who are doing this if you are in say IT this one then who had require trained IT professionals this and if it is of course financial and power etc so the resources that are there could be sometimes I said specific human resources could be as a specific clusters could be a set specific and also the power requirements.

Could be huge if depending on the particular industry you have for example if you have a cement industry then they kind of few out that that you require could be highly asset specific so and then finally you have the institutions taxes tariffs and special economic Jones free Road and also social craft social groups social groups come in here because if the it depends on the industry if the industry has a lot of GHG greenhouse gases.

Which are coming out or the sulfur or if see if it basically gives in to a lot of pollutants into the water under the into the ground then the social groups may have the problems associated with this so this is you whatever issues that we have considered any cost we have put them all here these are called transaction class now there is a theory that when do you outsource a particular. Activity outside you outside the transaction cause of the cost of doing it locally inside the factory or inside the your company is in is more than what it is done outside so you can actually use this particular diagram to find out the supplier supposing you want to make a decision you want to do make it make a particular auto mobile product within your company or you want outsource.

Outsource to where outsourced to China outsource within the local company local in India or a my then in the US wherever you are now you go have an excel sheet and find out all the costs that are associated using this particular diagram here and you have to add one more that is the

Coordination class which is the broker fees so if you add all this which are the transaction cost then you can use this particular this one for the selection of suppliers in other words if you want to sell and select suppliers for a particular component and you can use optimization problems to minimize the total cost associated with this or you can use the transaction cost which if you have all this data that is available it is easy to compute the transaction cost.

And make a choice between one country one supplier in one country to another supplier in another country or and also you can add the risk cause you know supposing depending on the governments depending on the location of the country supply there could be more financial and other risks for the supplier may face so you may want to minimize both the transaction cost as well as the risk professions so some of these could be obtained as data and some of these could be subjective information like good bad or ugly or something then you can use all these who do basically determine useless transaction cost to determine the supplier selection or in your analysis.

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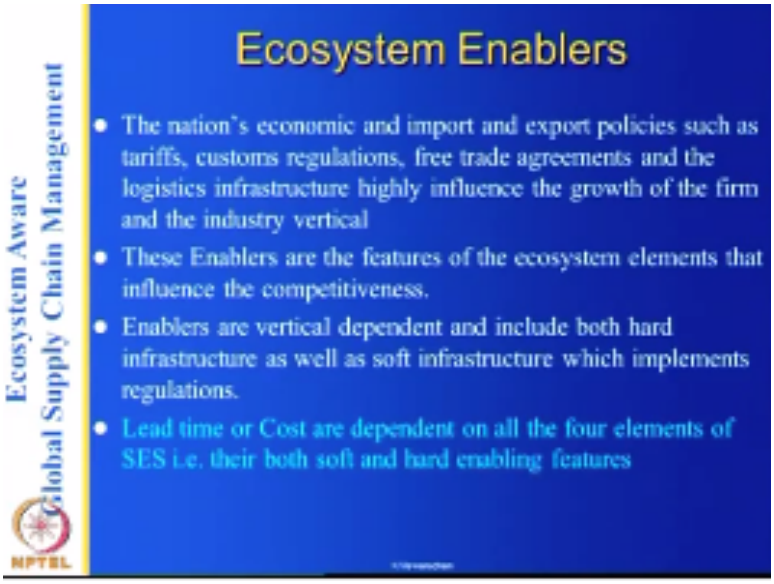

So far about the cost leaf type as well as the cost associated with this now I have shown you the in terms of the cost as well as lead time how various ecosystem elements contribute towards they both the lead diamond cost let me put it all together and right at ten thirty what are called ecosystem enables so here the nations economic on import and export policies such as tariffs customs regulations free trade agreements and the logistics infrastructure highly influenced.

The growth of the form and the industry vertical I think this is something which we have already talked about these enablers are features of the ecosystem elements that influence the competitiveness enablers are vertical dependent and include both hard infrastructure soft infrastructure which implements the regulations as I said before if you have a vertical say oil and gas then the kind of infrastructure that you need the kinds of rules and regulations.

That you have the kinds of resources that you need or different from if you are talking of an electronic vertical or an apparel medical or textile this one so or a food vertical so the issues one should understand that these enablers are what we call dependent and lead time our cost are dependent on all the four elements of the supply chain ecosystem and they are both soft and hard enabling features this is one thing that people have to realize that if you are doing a supply. chain performance analysis just based on the supply chain this one using queuing theory or using any other methods which is standard methods which are available in the literature or Mark of Chains then you will be making a big mistake viewing do not include all the four elements of this what happens at your ports and what how does your regulations affect your lead time and how does the availability of the other human labor available human labor productivity how does it affect your costs how does it affect your leads and so on so it becomes very important to is to analyze.

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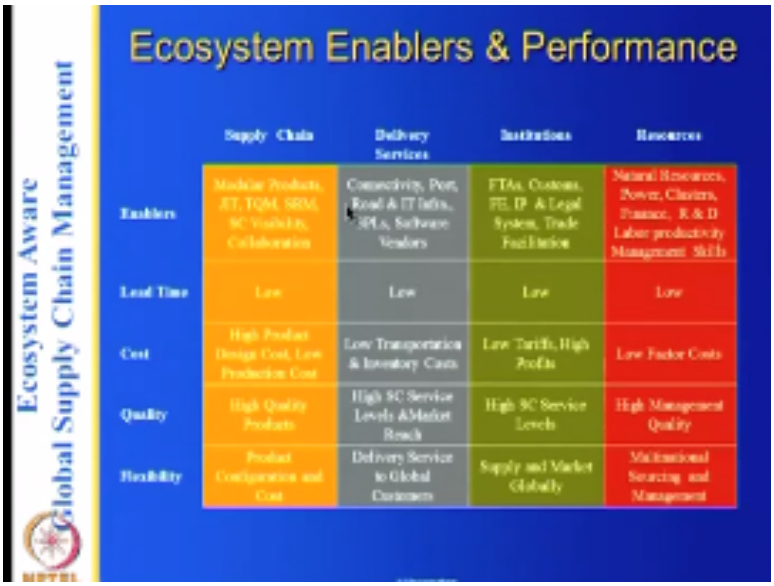

This so let us do some sort of analysis so here I have the an example of the so called enablers in other words I have the supply chain delivery services institutions and resources these are the four elements of my supply chain ecosystem now what are the enablers now I am talking of a general or a generic supply chain modular products just in time total quality management supplier relations management supply chain visibility and collaboration well all of us know that if you have this these are all good things that a supply chain can have and they becomes enablers.

Enablers were what enablers were reducing the lead time for a Joe's any cost and so on and what are the enablers for delivery time a nebulous meaning there are they are good features which will enable this particular you call this is a good service for example delivery services connectivity between two places the ports roads and IT infrastructure third party logistics providers software vendors and all that these are all the enabling factors.

That you look for if I am looking for a delivery services and similarly what about institutions what do you look for the governments and social groups free trade agreements customs duties foreign exchange regulations intellectual property and legal systems and trade facilitation and so on because when I am importing or exporting from a particular country I want to look at the business rental s here so that is where this I look at the institutions and of course.

I look at the resources natural resources power clusters finance or any labor productivity and management skills well you know what I have here or some of these things you can add depending on the vertical you have depending on then all that you have depending on your situation you can add or subtract some of these enablers now if I have all these enablers what happens to my late time in the supply chain I have all good things so my lead time will below. In the delivery services I have connectivity reports IT infrastructure and all that I have three pls hold o an excellent job so my delivery services will be low and I have institutions you know good customs good legal system Good trade facilitation then my lead time is low I have all the resources that I need I get the finance everything is efficient my late time is low so what I have here is all the enabling factors that that are needed for a good supply chain I have put and my lead times are low but supposing you know I have I have for example finance problems and in

other words to get an LC it takes one week then you know the resources here then this low becomes medium and similarly.

If the customs takes eight days or for clearance then you will have a problem here so these are all the enablers which are good features of a supply chain I mean of course this depends opposing you are talking about green supply chain then these could be different we will be doing in the future classes and the lead time is low if everything is good and depending on the actual situation you can actually have an excel sheet to rank order them and find out.

What is the what is the lead time and if you are comparing two suppliers for their lead time and depending on the countries there are you can basically get an idea of what think what the lead time is going to be depending on these factors you can actually give scores for each of these factors for this for a particular country and depending on that evaluate the supply or this one and it is the same thing with cost if you have a modular product then the high product design cost well and then no production cost because production it just assembly.

Of standardized components but in the other hand you know you have to the integrated product design is cheaper than modular product design that is the assumption in saying high product decide cost and similarly in terms of the delivery services if you have labels been good then low transportation and inventory costs because if you have high connectivity and good delivery services then your lead time is low so inventory is low and low tariffs and high profits is with the institutions you have and no factor costs if you have all these good things.

So your cost is going to be low but on the other hand if your Finance is expensive whatever loans you take this your LC is expensive then this goes up and similarly if your custom duties are high then this goes up so basically you can compare using this the particular diagram very easily using an excel sheet they supply us between two places and they are in a particular choice this is basically the transaction diagram cost diagram.

That I have shown and that can be used for optimizing or selection of suppliers or any of the other players and so on and similarly the quality high quality products is the supply chain has high quality products because it has all these features and high supply chain service levels and market reach if you have the delivery services this and institutions high and supply chain service levels because all the institutions are trustworthy and good and in terms of resources.

High management quality because you have all these resources which are available and their management skills associated similarly flexibility product configurations and cost you can supply various configurations of product so there is flexibility there is delivery service to global customers because your delivery services are good supply and market globally that is institutions and the resources are multi time multinational sourcing and management it becomes possible that because of the flexibility increases because of multinational sources and so on so you can also the flexibility in terms of institutions is because you can supply and market globally so what this diagram shows is that the performance which is usually done using Mathematical techniques can be easily translated you see the how the ecosystem parameters affect the performance and this is a very good diagram I think you can make an excel sheet and use it.

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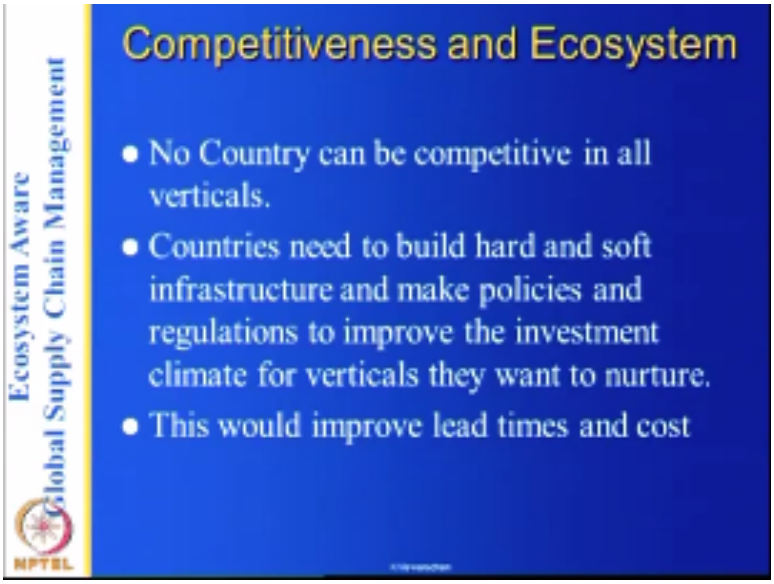

So what is competitiveness and echo system no country can be competitive in all verticals I think people should realize that and the biggest decision any country can make what are the verticals in which I want to be competitive and which will produce employment for them to my people and it will make my country globally competitive and others dependent on my country continue to build hard and soft infrastructure and make policies and regulations.

To improve the investment climate for verticals they want to nurture so for example though everybody says oh you build the ports you build the roads and so on but what is the return on

the investment for these particular roads so if I roads are important for people to commute but commuting roads are different from the roads were for business trucks look with this one so basically what one should see it is to improve the lead times as well as the cause so you make appropriate policies.

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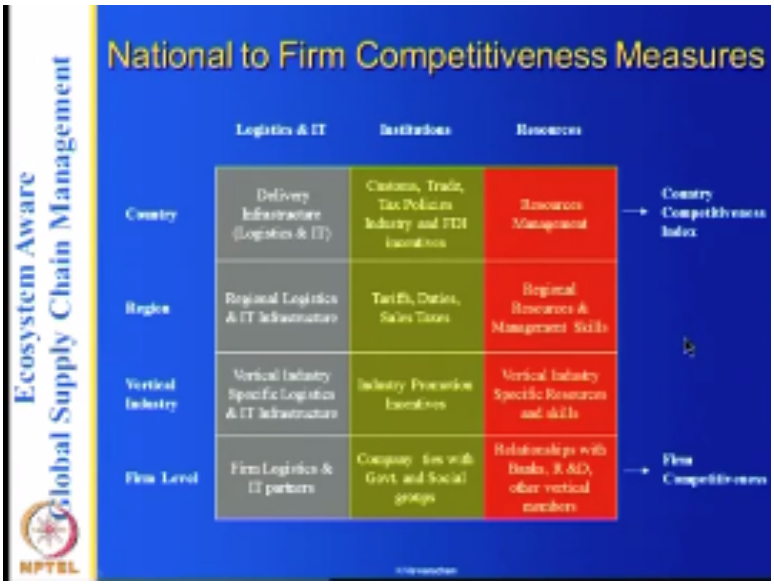

You can improve the competitiveness or this what cost well you have various kinds of competitiveness national to form competitiveness measures you have country competitiveness you have regional computation as vertical industry and firm level at for example in logistics and IT delivery infrastructure institutions or customs and trade and resources or resources management and that improves the country competitiveness for example you may have resources but you do not know how to manage in other words you may have an agricultural land but you do not know how to use that to produce their food so that is the kind of resource Management skills becomes an important from the point of view of the country any country but on the other hand you may not have resources but you may have resource management skills so you can import the resources you do not have oil you can import oil and have an oil factory a petroleum refinery which you can sell and make money so the management is an important factor in this and similarly at the firm level you have firm logistics and IT partners.

That is for the logistics and IT and companies ties with the government and social groups this becomes important with this one that is called the social capital and the resources relationships with banks RND and other vertical members so if you are a company what are your real resource what are your resources in this and the resources curve as we said it can be soft skills or it can be it can be strong ties so that is where I think the forms competitiveness.

This one if you are an Orchestrator you may not want any resources but if you have good relationship with people and if somebody wants to be done something depending on the designs you try to out outsource it to various people and coordinate the relationships and you can deliver the product or the customer this is called station which we will be later and similarly the regional competitiveness vertical industry competitiveness.

Are all depend on this one let us look at the vertical industry vertical industry specific logistics and IT infrastructure if you say India is a small hub as a small car hub then you should have those specific logistics for transport of components for transport of this one and IT infrastructure ERP and other packages industry promotion incentives like for example in the IT case India is generated is this one given a lot of thoughts to IT companies as free trade Jones and I see Jets and so on and resources its vertical at industry specific resources on skills like human resources banks loans and then the other kinds of industry clusters for the vertical industry so it all depends on planning this gives you an idea of how to plan a vertical industry as I said no country can be very good in all industry.

Industry verticals but it is important that the country has to first choose what is the vertical it wants to be competitive and appropriately develop all the instruments for this from the supply chain.

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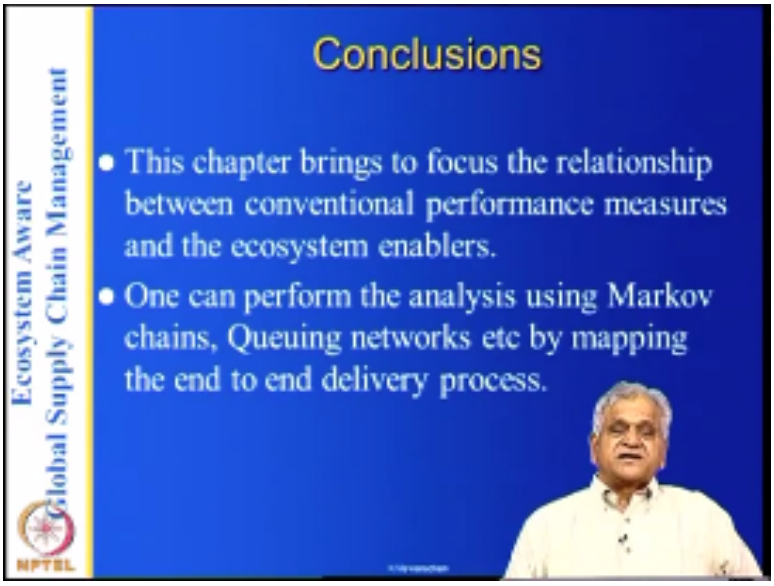

So basically to conclude here it says this chapter brings to focus the relationship between conventional performance measures and the ecosystem leaders we have defined the late time and we said what are the components are the lead time and more importantly we have shown How each of these components of the lead time are influenced by the ecosystem parameters because each of these ecosystem parameters.

If you want say logistics then there are logistics providers if you want some policymaking then there you have to approach the government there the addition make us and that is how the performance can be improved that one can perform the analysis using Markov chains queuing networks etc by mapping the end-to-end delivery process so you can basically take an example of the end-to-end supply chain and write a basic queuing network.

How your product is traveling through the entire supply chain and if you if you are at the port then you are your container is waiting for clearance then you are waiting in the queue all right if your container is on it on a truck then they practice on the road then you are waiting in the queue so you can basically write a queuing network from the entire global supply chain and find out it can be an arbitrary general queuing network or it may have special features.

Like closed schools or whatever it depends on the particular problem that you have and you can also write the Markov chains for this and from the end end-to-end delivery Process and calculate the leak times you could do system dynamic simulations of this once you do system simulation dynamics you could do sensitivity analysis of if you change the policies how does

your lead-time is affected if you choose some other instead of air transport we will choose shipping transport how does it cost effect how does your lead times affect so if you choose in the stuff one country another country instead of searching from a chain is supplier if you chose from Vietnam is supplier.

How does the only times another things change so basically one can find out do this analysis either by simulation Markov chains or currents etc by mapping the entity deliver whatever we have done for earlier in manufacturing supply chains manufacturing supply chains you we could do this using this chapter this particular lecture material you could do analytical analysis you can use AHP if you do not have data if you have subjective like say the institutions are good institutions are made and so and so you can give scores for those institutions you may not have to have data of this then you can use analytical hierarchy process you do not get this.

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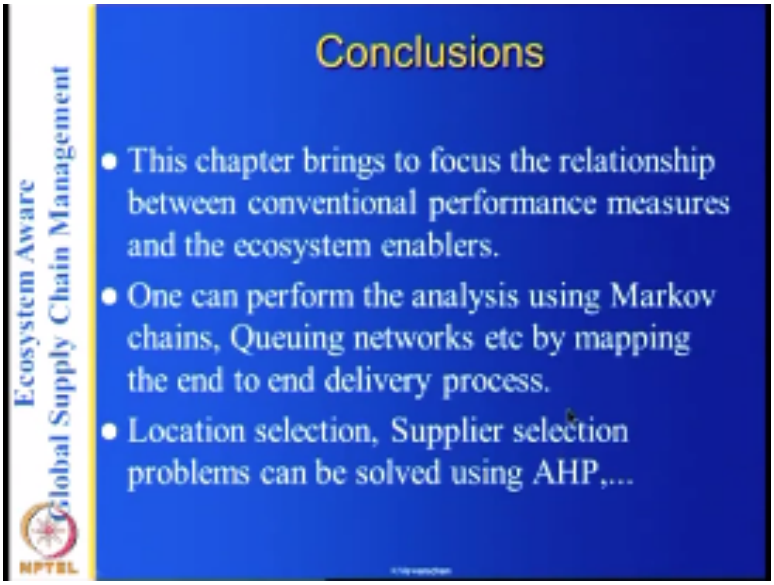

One so location selection supplier selection problems can also be solved using analytical heredity process so I mean to conclude this chapter this is an important chapter in the sense you have basically related the supply chain ecosystem to the conventional performance analysis that is conducted in manufacturing networks and supply chain network using Markov chains so then queuing networks analytical hierarchy process or simulation so you could do all that but in the global supply chain you can find out steady the sensitivity analysis of how your lead times cost and other factors the supply chain performance changes with the countries making different

rules with the ports you are entering and their trade facilitation issues and so on so they are not of sensitivity analysis that you can conduct thank you.

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