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Global Supply Chain Management
Lecture – 11
Supply Chain Risk –part 3

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Actually we are going to continue where we left on the supply chain risk.

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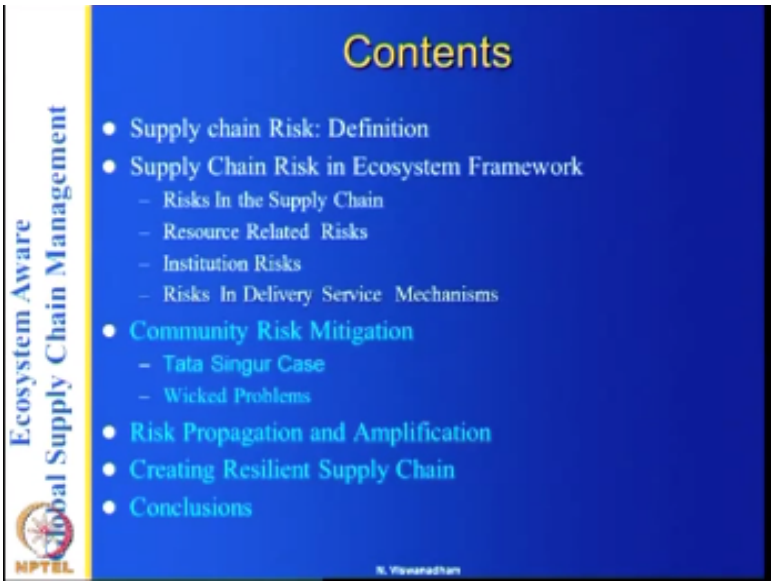

Last time what we did was we had taken the definition of a supply chain risk and also dealt with extensively all the risks that can arise in the supply chain a resource related race reinstitution race and risks in the delivery service mechanisms are given lots of examples to give the risk why is it important to list all the risks that that happen or that influence the supply chain so this is because unless you diagnose the fault you cannot rectify it so it is very important that do you know what are what are all the risks that then you can try to mitigate the risk.

So what we are going to do today is about the risk mitigation strategies so the community risk is one of the biggest risks particularly in emerging markets like in India and I will take one example like what is called the Tata single case where the Tatas had an automobile plant which is for the Nano which is a 1 lakh car which is a very popular car and that has been in West Bengal in place called single.

And they have to move out and that was because of the community risk so such things like that happened several times in several cases where we have seen last time the infrastructure like roads supports buildings and so on they take lot of time that is because of land acquisition and other problems so land belongs to somebody who is either farmer or somebody and then he does not want to sell it because if he waits the prices real estate prices will go up.

So but whatever reason people do not want to sell on your Ignace going against his free freedom of speech freedom of action and so on so what we need to look at how do you relate that risk kind of thing it is a very special case that is why I have separated this from the rest of the lecture that is because community risk lead to what is called wicked problem which are well difficult to solve has to be solved only through negotiations and so on.

And the second thing is this propagates on amplifies so we had to take an engineering approach when you are trying to create a resilient supply chain what is relatively a resilient supply chain you have your system should be able to function in spite of the faults that occur inside the system inside so inside in spite of the failures if you take a computer if you have a dual processor than if one processor fails the other works this is called triple modular redundancy.

And other kinds of things and if one sensor fails in a thermocouple sensor fails in a boiler then still because there is an alternate way of measurement of the temperature still it functions so in engineering systems people are used to there is nothing no engineering system is failure so there is a maintenance there is a maintenance repair and operations always trying to do once a failure happens so we should borrow some of these concepts of engineering maintenance and repair in to supply chain.

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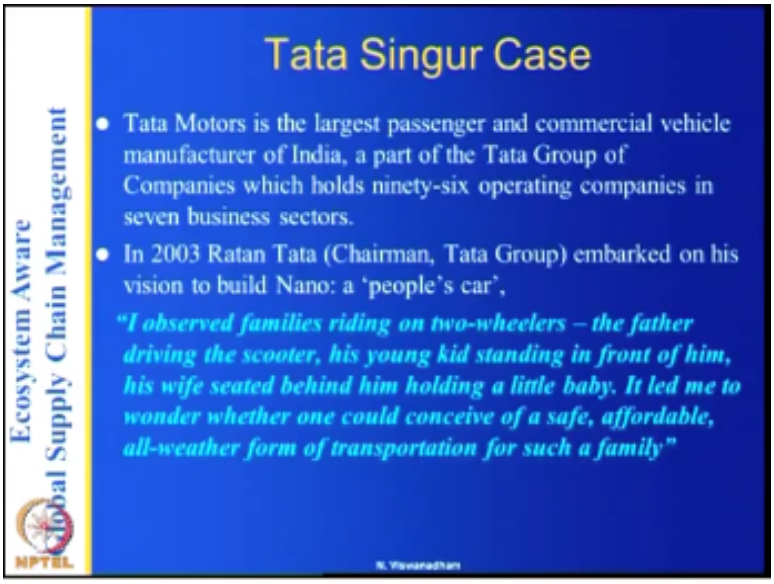

And see what we could do here that is what how we create resilient supply chains and finally we conclude this so let us look at what is Tata singur case Tata Motors is the largest passenger and commercial vehicle manufacturer of India a part of Tata group of companies and it holds 96 operating cup in seven business sectors his daughters are there it is a very famous company in India in 2003 Ratan Tata chairman Tata group embarked on evolution to build a Nano.

What is called a people skull why he says I observed families riding on to Venus which is very common in India the father driving the scooter he is anchored standing in front of him his wife seated behind him holding the little baby it led me to wonder whether one could conceive of a safe affordable all weather form of transportation for such a family well when you are using a scooter I said to wheeler then if it rains then you cannot travel.

So but on the other hand he wanted to create for almost the same price which is safe affordable and all whether former transportation for such a family which cannot afford the usual cost that we have so this is where his mission was to have what is called M 1 lakh car well lakh is one hundred thousand rupees which is equivalent today to less than two thousand dollars.

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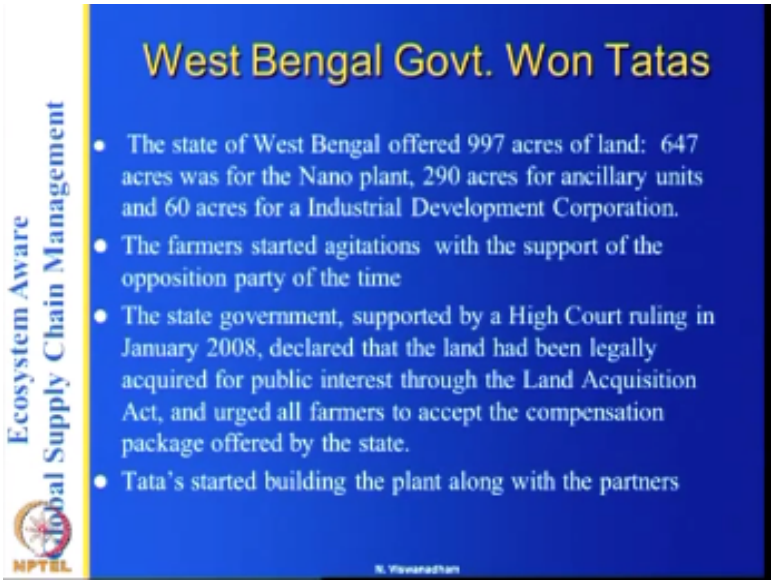

So several governments then taught us at but at this idea then several state governments they wanted taught us to establish the plants and they were offering not of subs the state of West

Bengal in Calcutta it offered nine hundred ninety seven acres of land 647 was for the Nano plant to ninety acres for ancillary units and sixty acres for Industrial Development Corporation so the total is approximately one thousand acres and the farmers started as stations with the support of the opposition party.

Because these are this is a fatality where the farmers were using produce and it is the produce that they that they are using for the support and livelihood so the farmers started Ice Station and the opposition parties they started they helped the farmers to my estate more and the state government supported by the High Court ruling so it all went to the High Court and the High Court ruled that in January 2008 now the land has been legally acquired for public interest through Land Acquisition Act and out should all farmers to accept the compensation package offered by the state.

Now here what happens in India is that the state wants the land and it acquires from the farmers and it delivers gives it to the industry now farmers are saying industrialists are making so much of profit so why not they pay more so there is a compensation package and in issue that is involved and Tata started building the plant along with the partners so the issue here is there is a vision to have a low cost car for affordable by lower middle class families and the state government wanted to have that plan so it can create jobs it will create it will boost the employment potential and the economics of this state.

So they are given approximately 1000 cameras and from taking it away from the farmers and since it is all legal and the High Court also is ruled in favor of the Tatas on this particular project and Tata started building the plant.

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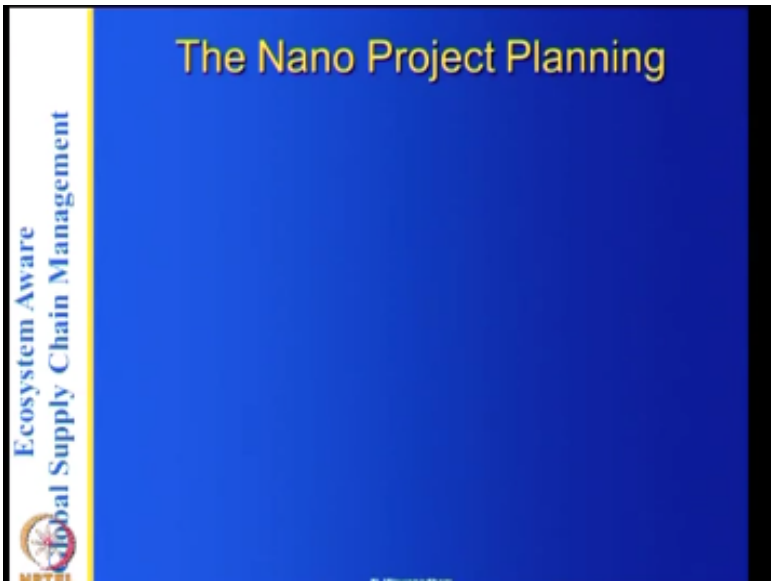

So the supply chain was meticulously planned you know there because it is a one lakh car it is a low cost car so whenever there is a low cost we hurt to minimize the cost rate over the place so that is where it meticulously planned collocating all the vendors so that the transport costs are minimal auxiliary units and proximity of the plant and what is called the copper Highway in Kolkata in West Bengal and it is closer to the port so the transportation is also is also cheaper.

The land acquisition procedure and short on the dress were not seriously taken by the Tatas well so and there they relied on the government of West Bengal which also took the judiciary into the one to look into the land acquisition procedures and they started building the plants.

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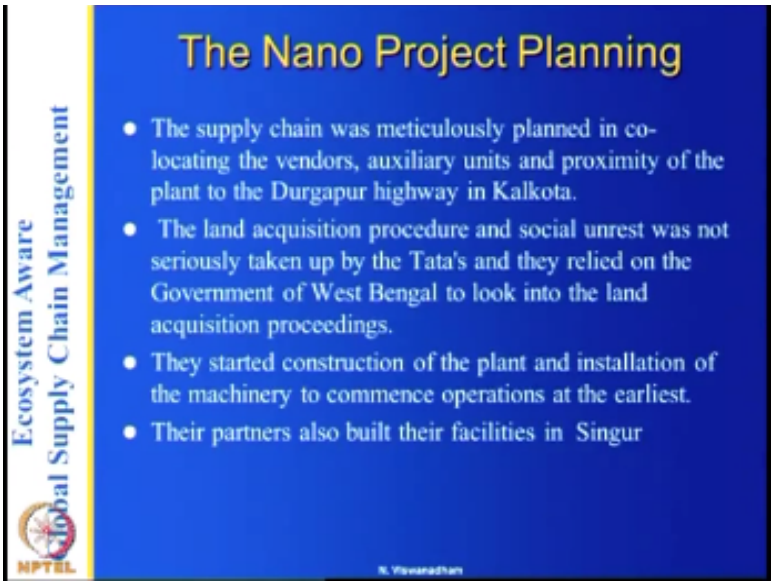

So they started construction on the plant and installation of the machine to commence operations at the earliest their partners also built so basically there is something like rupees 50,000 Crores have been spent in making this present planet so I am going through this phase through the whole procedure that is because what is what is what went wrong and finally all of us know that not us had to leave this and the project came to a grinding halt and that has a mood to another state before nano was rolled out.

So when everything was taken when that I think that they have followed all the procedures meticulously followed the book what went wrong the Nano was supposed to be launched in a month.

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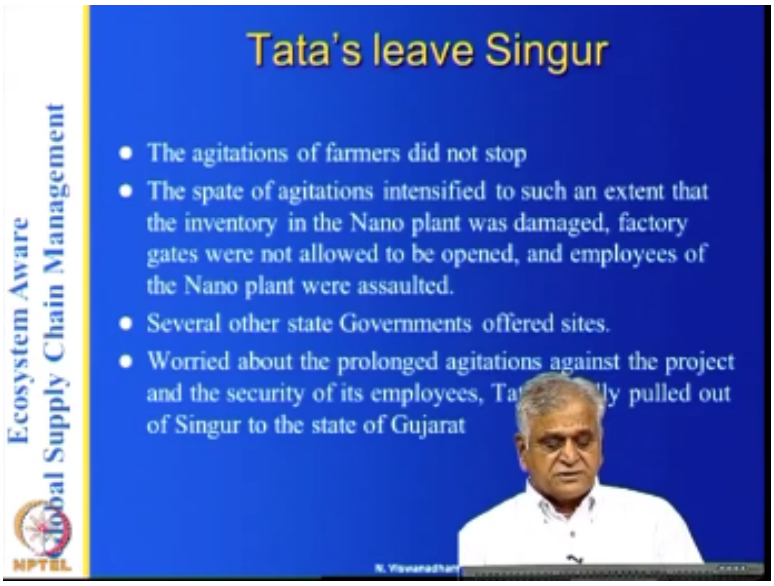

Then Tatas leave Singur because the agitations of the farmers did not stop the state of agitations intensified to such an extent that the inventory in the Nano plant was damaged factory gates were not allowed to be opened and employees of the Nano plant were assaulted so there were people city opposition party members and farmers sitting on hunger strike and they were sitting in front of the gate they are not allowing everybody if anybody wants to enter the plant then they were assaulted them.

So because of this kind of situation several other state governments offer sites so you should see the opportunity other government state governments wanted to take this opportunity worried about the prolonged isolation Cygnus the project and the security of its employees now it does finally pulled out of synch how do they stay doctor are now quit restate offer them enough incentives and so they basically went out of this one.

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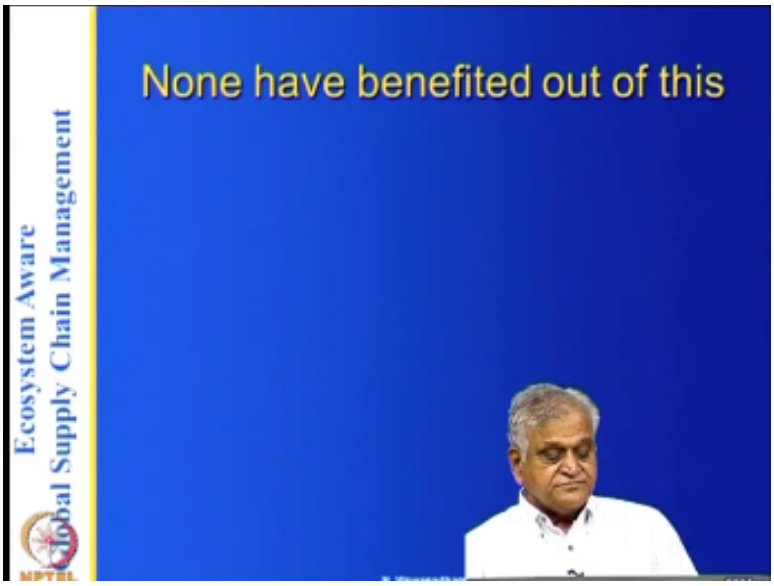

So what is this what does the story tell us the story is that when you want a test land there are two kinds of any year in the supply chain case there are two things one is the project planning what is project planning you have to acquire land build your facilities and bring your machinery and put everything in place there is the first project plan the second thing is once you have installed all the machineries then you should start your production and start the supply chain planning.

Now there are two aspects to different aspects to this now the people that we really the industries make is they will have this AMCU over both the operations in other words for a project planning which involves land acquisition building construction acquisition of machinery and so on and dealing with the locals any problems and so on these are all the project planning problems whereas once the machinery is set the supply chain planning is all professional.

So if you offer supply chain planning can he handle the locals can he speak the local language can he talk to the government can he talk to the judiciary can he talk to the opposition parties can you negotiate with the opposition members and so on and try to arrive at a decision the answer is a big know the capabilities that are needed for running a smooth supply chain factory and there are my knowledge that is required there is much different from running a project.

Which is particularly highly sensitive to the locals and he should know the local language he should know the local politicians you should know the local people and so on so basically and try and speak the local language to convince people but that where the whole thing went wrong none of them benefited.

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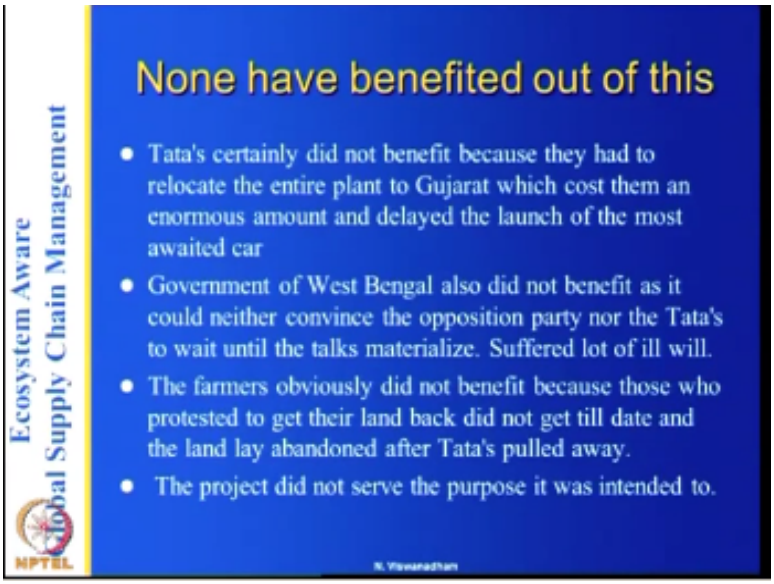

Tata certainly did not benefit because they had to relocate the entire plant which cost them a lot of money and it has also delayed their water to their largely the Nano in a month but it has got delayed and the government of West Bengal also did not benefit as it could neither convince the opposition party nor he taught us to wait until the talks materialized and it suffered a lot of ill will because a lot of companies which basically wanted to establish along with the once the Nano is successful mister the New York Times headline says the world is waiting for Nano to come out.

Then once this has happened and taught us a lot of simple repetition and they have industries all over in all over India and there so if they cannot do it who can do it so that is the kind of magic that has given a lot of ill will to the state of West Bengal and the farmers obviously did not benefit because those who protested to get their land back did not get till date and they land abandoned after Tatas pulled away so basically once not us were pulled away the land becomes worthless that is because nobody wants that land and the whatever has been transferred to Tata.

It has not been transferred back to the farmers so the project is natural but was not intended to.

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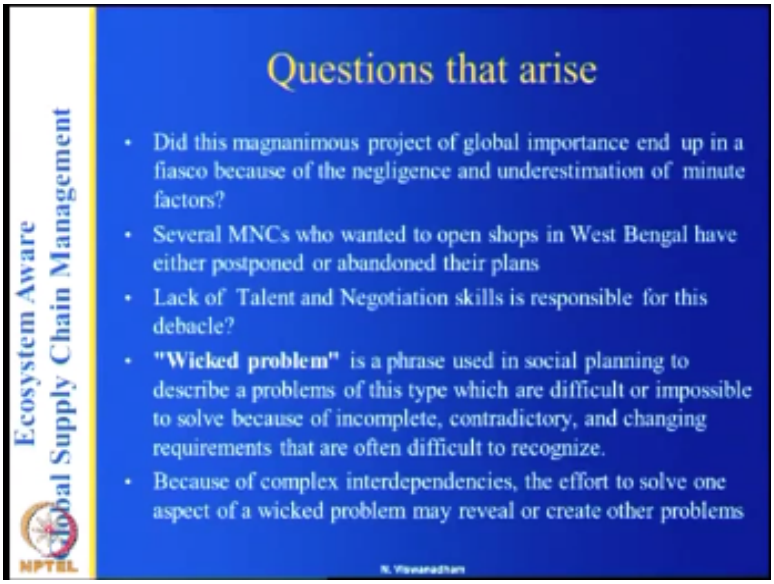

So what is this kind of questions that arise did this magnanimous project of global importance end up in a fiasco because of the negligence and underestimation of many factors is that this one the second factor is several advances who wanted to open shops in West Bengal have either postponed are abandoned their plans lack of talent and negotiation skills is responsible for this debate is that the problem.

Such problems in society whereas having partners government on one side the industry on another side the people on the side opposition parties on the first side and on the fifth side other states who are trying to your Tata set up is so they are five or six partners who are basically trying to get the problem solved in their own way so such problems are called wicked problems it is a French used in social planning to describe problems of this type which are difficult or impossible to solve they are difficult or impossible to solve.

Because of incomplete contradictory and changing requirements that are often difficult to realize recognize in other words here there are five or six players there were dominant players and everyone is right the farmers are saying look this is my land which my grandfather has given and if you take it away I do not have any food if you are giving me then we give me a

proper compensation before you take it then the comment is saying look if he thought has come here you know the others also will come the economy of the state will improve will provide jobs and so on it is good for the further three way state of West Bengal.

Well the Tatas are saying look if you there are several offers but we came here because of the port of Calcutta and also since you are offering the land at a convenient price for us and we came along with all our people so and it is a 1 lakh car so we cannot afford to pay much more well the opposition party is saying look you know you have bundled this and we are a party we are on the part on the side of the or the poor farmers we want to support them and other states are saying look you know we could we will give you a lot of shops why do not you come here.

So everybody is right in this world so how do you solve such problems because of complex interdependencies therefore to solve one aspect of the wicked problem may reveal or create other problems so if the.

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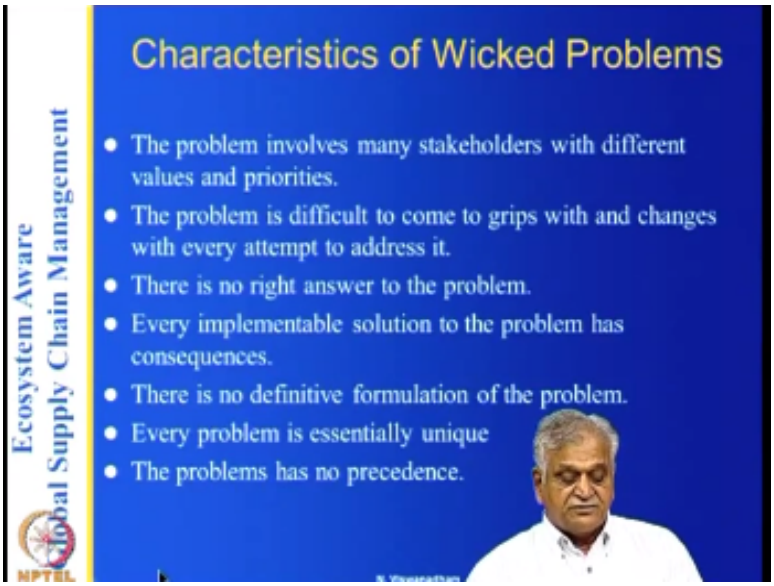

So these are called wicked problems how do you solve wicked problems let us look at source of complexity social complexity is a function of the number and diversity of players involved in a project the strong and accurate opinions of them so I mentioned in The Tatas ignore chance there are five or six partners each having their own opinions and each is right and the conflicting

views among various stakeholders lead to my acceptable solution causing projects not to take off so.

Here there are conflict farmers want more money Tatas cannot give they want it immediately the state of West Bengal want to give the compensation as agreed and opposition party wants to bring down the ruling party the various everybody is right in their own way they are playing their cards so but is it possible to negotiate in such a case the problems in which social complexity is coupled with fragmentation of decision making is called wicked problems let us look at characteristics of wicked problems.

The problem involves many stakeholders with different values and priorities the problem is difficult to come to grips with and changes with every attempt to address it now I do not know whether the West Bengal or they Tata recognize that they were it was a wicked problem and it was a failure of negotiation skills because it is very difficult to say they think that you know this is this is a straightforward problem somebody did not agree so we moved out and so on but on the other hand there is a community loss here in other words for the Year Tatas have spent.

And Tatas have last money everybody has lost money without any gains so this is a loss of the country so this kind of things should not be happen and so on and each time you change at one point it is between Tatas and farmers another time it is between opposition and the state and the state government at another time it is in the court between the opposition the state government and Tatas and so on and another point it is West Bengal versus other states so the problem should start shifting.

So there is no right answer to the problem yeah everybody is right so every implementable solution to the problem has consequences yes it is also easy to see in this there is no definitive formulation any problems in other words you cannot solve this as an optimization problem they are called hard or problems and every problem is essentially unique and the problem has no precedence in other words if it happens of course when if we say Land Acquisition Act Land Acquisition Act the land is different in other place it is different in Tamilnadu.

Which is different in some other state so but still the land may be learned but the problem becomes unique at every place at one point it could be for a port at another place it could be for some other industry at some other point it is for a plane or a power plant and so on so one has to treat each of them has a unique so.

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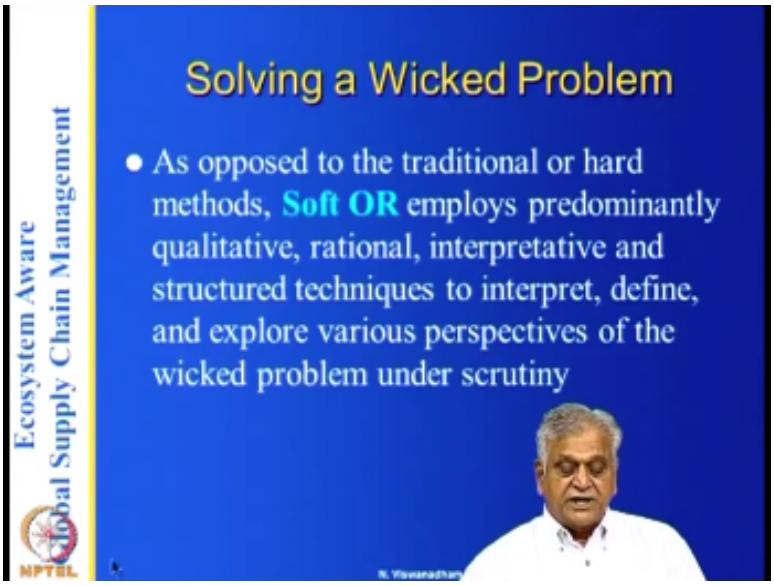

How do you solve those problems so traditional way of solving such problems decision making problems is what is called operations research use lot of optimization modeling simulation and so on but what we here are soft or this is the term that people use that is soft operations research employs predominantly qualitative rational interpretative and structured techniques to interpret a fine and explore various perspectives of the wicked dragon sadness Courtney so basically there should be somebody who looks at the entire problem.

And is it then the most important thing that one has to look at here is it important to solve this problem and find a solution should doctors really get this land well if it is an interest of the society interest of the government it is the interest of the economy and if one decides that since they have already started this it is good for the country good for the people and so on then one should try and negotiate this.

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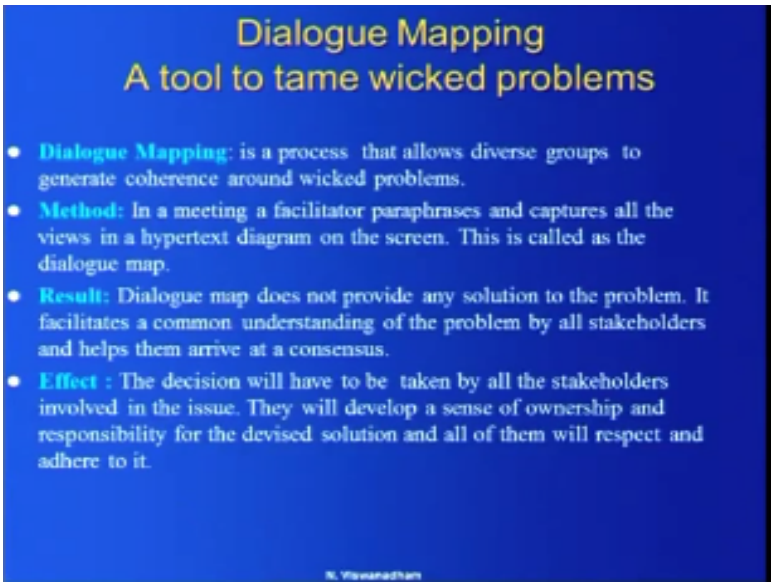

What are the negotiations it is called dialogue mapping learning mapping is a process that allows diverse groups to generate coherent surround wicked problems there are several ways of solving these wicked problems for example a government can bring a law saying that it is allotted and any actions that other by anybody does is illegal and they are liable for prosecution that is an authoritative way of solving it so well that that has also done in several countries and several places and it is possible to do that.

But there is another way of doing is called a collaborative networking in other words you talk to people and have a dialogue and convince them it is a project that has to be approved and you find out who gets what and negotiate and his fellow was behind in this particular case the farmers instead of getting X amount for their land to occur they get 0.9 X amount so the farmers go back and they said in stuff Tata say they mister paying something that us it may say that they will give jobs to some of the people in the farmers sons daughters who are who are employable.

Instead come and say it may give some money to taught us to compensate for all this so each one retaliates go back goes back and then renegotiations this is a collaborative way of nation making then problem is solo the method in a meeting facilitate or paraphrases captures all the

views in a hypertext diagram on the screen this is called a dialog map and the resulting dialog map does not provide any solution it says allocates common understanding the problem by all stake stakeholders and helps them arrive at a consensus.

So when somebody sees this is good thing a tool to be done and it has to be done and let us negotiate whatever buddy gets it and it is an interest only people of this country and so on and the effect is detection will have to be taken by all the stakeholders in want the process and they will develop a sense of ownership and responsibility for the solution and all of them will respect an ad here so whatever solution is obtained from dialogue mapping this is a tool that to tame the wicked problems it is basically no you are solving in a collaborative networking fashion these problems I mean there are several problems of this kind and I do not know whether Tatas followed this dialogue mapping have a meeting every time it ended up with in a chaotic fashion.

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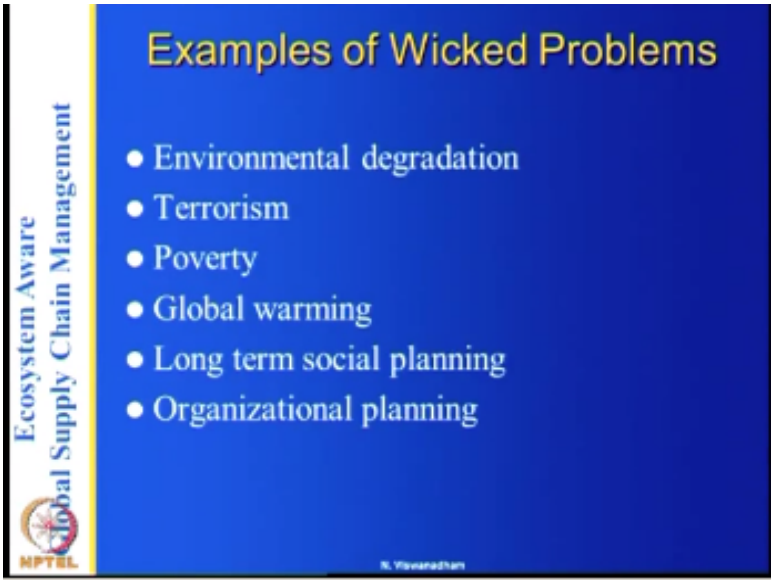

So there let a lot of wicked problems that are there one or environmental degradation that is this terrorism I mean particularly jihad terrorism they think they are saving the world they are saving their religion that is having their people and poverty global warming long term social

planning organization planning there are several wicked problems which shows all over like this and so on so.

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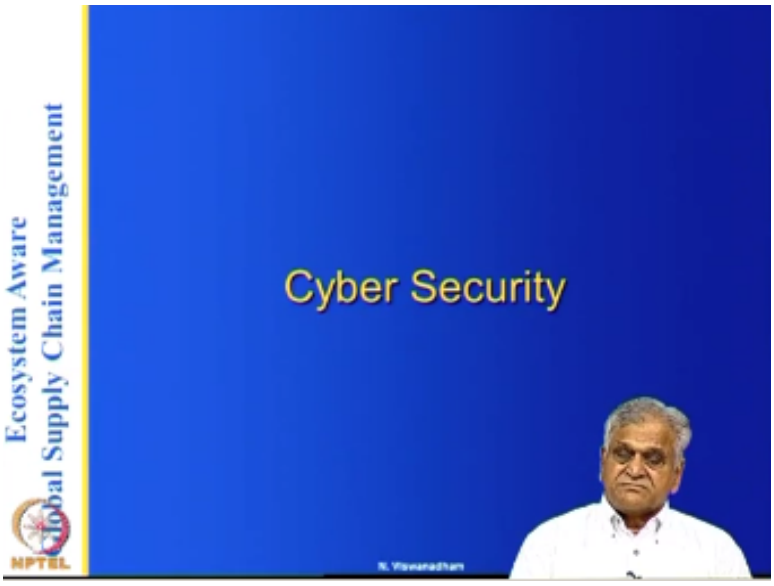

They suffice it to say that there are lots of problems particularly the institutions face that the community risk particularly coming out of land water for example installing nuclear power plants in a place and then the government say we want a nuclear power plant we want a green power that this one the coal power is not good we do not have enough coal and so on and the people say if there is a blast then we will get affected so there are several issues that come in here.

And either the government has to come in an authoritative way or it has to convince people that they will take all the precautions so that the nuclear disaster would not happens even if it happens they will mitigate that risk and they in an understandable way to all the people they should put all this on a piece of paper and circulate it or explain it to people so that is what happens only in the community problems another important problem that is facing the governments today with the cyber security.

As we have seen earlier that supply chains are highly connected they are connected through the all the goods information and financial flows are connected and the internet plays a very big role in connecting the information and the finances and so on but as we also saw the connectedness also brings risk and one of the risks that have been discovered in the last two years is what is called cyber security so what are cyber risks disruptions to supply chain flows caused by IT defects of damage now what happens if you have power networks raised.

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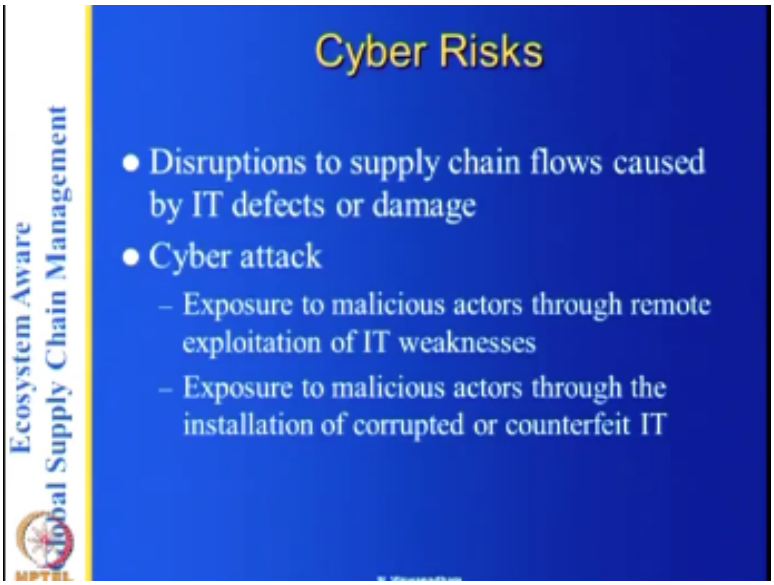

Well everything comes to a grinding halt you may have a battery backup but the backup only works for some time but what happens if your IT system goes you do not have any backups I mean you can have backups your battery for your cut you own computers and so on what about your network so it becomes on operational so the flows there is a disruption to the flow of supply chain flows by IT defects it is called cyber risk and this cyber risk if it happens due to a natural calamity that is a different thing but it is happening as cyber attacks.

In other words somebody is doing this intentionally this is like a war so exposure to malicious actors through remote very Mort exploitation of IT weaknesses in other words somebody gets into your computer he steals all the files all your passwords and so on exposure to malicious

actors through installation of corrupted or counterfeit IDs in other words the software that is there in the computer is counterfeit or corrupted so it is corrupted with a virus and the virus will send out all your password.

All your information whatever you type it is transmitted to somebody yes so they know your username and password to your bank account and they can basically steal your money so the cyber attack with all the innovations that we discussed earlier this cyber attack is a big this one now cyber attack by people it is different but what is happening cyber attack by people the terrorists and thieves is a different issue.

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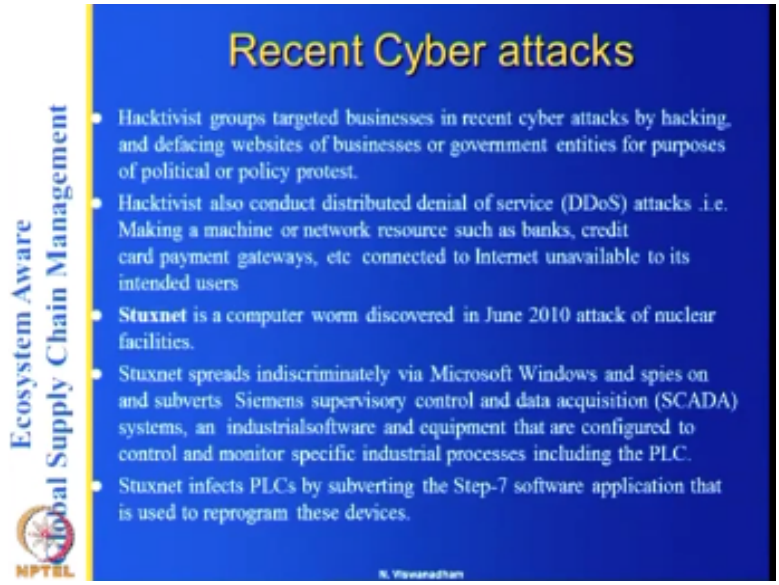

But now the recent cyber attacks or by the governments and that is the problem that creates another thing the activist groups targeted businesses in recent tiger attacks by hacking and defacing websites of businesses and government entities for purposes of political and policy protect well this is one thing you know they enter into your website and change all your bio data and other things your policies so that will you get a bad name.

And hacker is also conducted what is called distributed denial of service attacks that is they basically a network resource like a bank or a credit card payment gateways or connected to the Internet or a level are unavailable to the users so they make a particular server inactive that is

more problem is here is there is a software core is a computer worm called Stuxnet in June 20 2010 it was discovered attack of nuclear facilities of Iran in Iran nuclear power plant was disabled it did not function in June 2010 why it is because of this stuxnet computable what is this work.

You know Stuxnet specs indiscriminately why a Microsoft Windows and spies and sub Birds Siemens supervisory control and data acquisition system now the supervisory control and data acquisition system of SCADA is a very important thing in industries in industry with what are what are called PLC programmable logic controllers and all these PLC are connected to main computer and they are all used for data acquisition as well as control the leather words if you have a factory floor you have all numerical Merchants control machines each numerical control machine is controlled by a PLC.

All the PLC are controlled by to aid another PLC which basically controls whatever flows through the machine shop and now what happens is if that PLC is affected there are other words the Stuxnet infects the PLC by subverting step7 software applications that are used to reprogram these devices so it is the control system is affected is becomes defective then there will be a particular problem unless you have a redundant control system.

So but usually you do not have a redundant control system control system is the one that is supposed to take care of all the factors both you during faulty times and during normal times but here these people are affecting and these are Siemens products and same and supervised record and data acquisition systems were affected this was recent cyber attacks that made history now what happens here I mean this trucks net is supposed to have been done by some governments and to affect the Iranian nuclear power plants.

So this is becoming like cyber warfare between countries by a tie by disabling your aircrafts by disabling your nuclear power plants by desert disabling your power plant operations and so on because these are all standardized to control equipment which are accessible and if they are basically since they are accessible if they are pirated and you are basically once or basically attack those facilities then you have a problem so the world is entering in to do this one

interface where there is the risk attacks or increasing by the communities by the governments attacking the finances attacking the information infrastructure and the power infrastructure and all that is becoming a big issue notice.

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So what we did there so far is to is to consider all the risks now let us look at how this propagate work this one.

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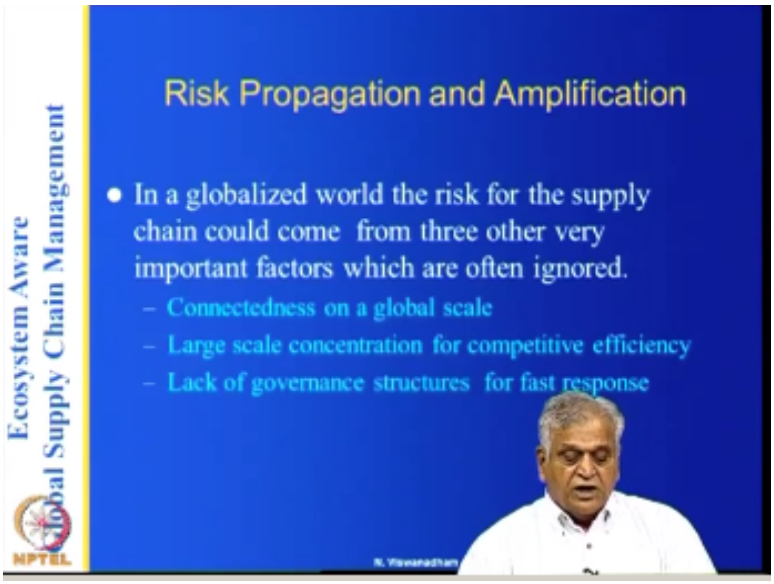

You know globalize well the risk for the supply chain could come from three from three other very important factors which are often ignored connect nest on a global scale large scale concentration for competitive efficiency lack of governance for fast response.

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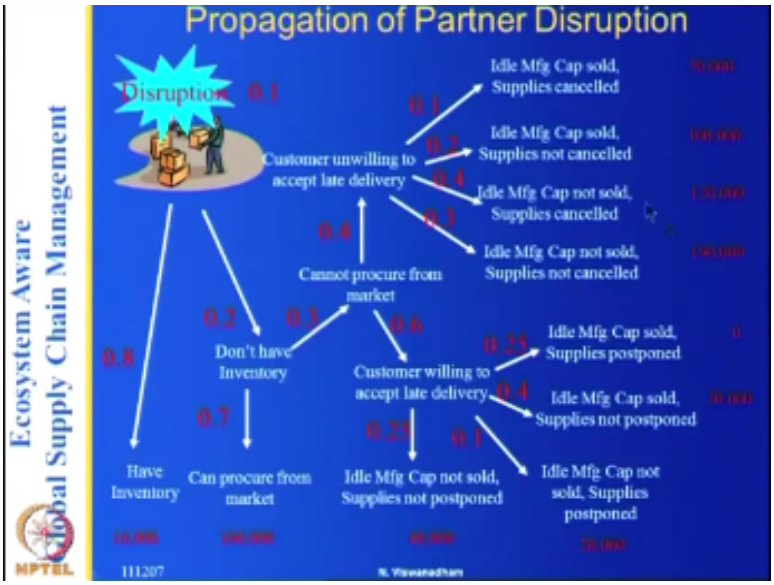

Let us look at a particular diagram supposing there is a supplier from you a sourcing and his there is a disruption in the supplier in other words there is a fire and it is factory all done so now what do you do you are sourcing from that supplier and the supplier for some reason becomes in effect so you sometimes you keep inventory okay or sometimes you do not have keep

inventory if you are a lien JIT and so on then you may not keep inventory so if you do not have inventory you try to procure from the market in other words you go onto the web you go to the open exchange or try to buy it or buy it from some other place.

Well most probably you may get it if it is not a very critical component which is specially made for you if it is a generalized component like a processor or a power supply kind of thing you can always able to access it but sometimes you may not be able to get it so what we are trying to do here is what is decision flow diagram how once a flow or once a disruption of course if you map like this then you know how to mitigate those kind of risks how the risk flows in the inside the your system.

So we have said if you have inventory then you do not have any problem you solved the problem point item probably the probability 0.8 you have an inventory you have a problem if you do not have an inventory and you can procure from the market then you procure it then you are done but supposing you do not have the inventory and you cannot procure from the market then customer unwilling to accept late delivery you go and call the customer saying that look you know I have my supplier failure so because my production has stopped because I have a tribe not trying to I am trying to access from the market.

I could not get it so can I deliver after one month well the customer is willing to accept the delivery then you are done then you can procure you have time you are basically buying time then customer is willing to accept a customer unwilling to accept the delivery here is try to procure from some other place and so on if the customer is willing to at the tannery idle manufacturing cap not sole suppliers not post world there to this one what happens is if supplier is willing to accept late delivery then you are okay.

As far as this particular supply is concerned but your manufacturing capacity you have scheduled the production of this particular product on your manufacturing line thinking that everything was okay your supply chain planning ERP systems they'll tell you have this particular product is to be made during this particular time fourteen fifteen of this month what do you do with that capacity so you try to idle manufacturing capacity you can sort but then you would never usually have one supplier.

If one supplier they are there several components but for an example in auto plants there are three thousand other suppliers who are supplying and basically for one this one the other suppliers either if you ask them you also possible because this component I am not getting and sometimes they agree sometimes they do not agree so you have several cases that is coming here I did manufacturing capacity sold supply is postponed that is an ideal situation idle manufacturing capacity sold supplies not waist one that is because you basically that is a very big chance.

So you have basically not postponed so you have to maintain the inventory of this supplies idle manufacturing cap not sold and supplies postponed this basically is another case so your capacity gets wasted away and your supplies you have to maintain this applies and so on and here if the Dickens customer is willing to accept late delivery then idle manufacturing capacity sold and in manufacturing quasi supply or not supply not canceled Idle man have a cap sold supply scattered our manufacturing capacity not sold supplies not canceled.

So you have four cases here idle manufacturing capacity sold and supplies canceled idle manufacturing capacity sold supplies not canceled and so on so basically what happens here yes when customer is willing to accept late delivery then you get into all this problems because you have an idle capacity so what I am going to try so is basically you were if you want to make a decision how do you create a resilience here one thing is you want to have in mentoring instead of going through all this idle capacity and all these problems.

You can basically have a cost estimates of all these options and you say look it is the better I have the inventory need not have to stop I have a fifty days or one month inventory then you know other things will take care of it so that is one way of doing it but another hand if you want to have a lean mean system and if I do not want to have inventory then you want to procure for the market in case you have an alternate source which is there then that is also fine but if both do not work out then you get into some kind of problems.

So this basically of course you will you will have a since your inventory then when you have been mentally you are idle manufacturing capacity you can the suppliers other suppliers cancellations these issues would not arise in this particular case in these two cases in those two

cases you are using the existing capacity as well as other suppliers but you get into this kind of problems only in the other two cases so what is this diagram tell us this diagram tells you the various factors that happens and once you know the probabilities that are also the cost estimates then you can decide whether you want to have inventory or you want to take a chance.

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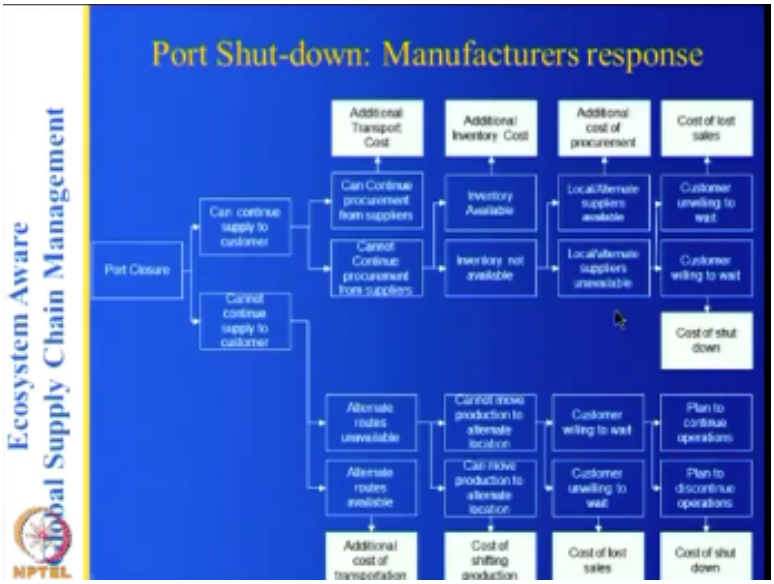

Another popular thing that happens in terms of the solid supply chain risk is what is called the port shut down or the manufacturer of sunspots now this happens very frequently for example the Los Angeles port the laborers were on strike and the port was shut now okay so where is the port they start down then in other words all the ships that are going there they cannot be unloaded and they have to be diverted to some other place or the shipments they are in touch should not take them and whatever goes through Panama Canal has to go through wire so users cannot suppose there is a strike on Panama Canal then you have a lot of problems

So if there is a port closure can continue to supply the customer then this additional can continue procurement cannot continue procurement from the supply that these are the options here and inventory you know for example customer inventory available inventory not available local alternative suppliers available local art and net supplies unavailable customer unwilling to

wait customer willing to wait so there is a basically several this one that happens cannot continue to supply to the customer alternate routes.

Unavailable in other words you can when the port closure you can still continue but there is an additional transport cost in other words if it is say there is a shipping strike you can go to another port and continue the procurement from the suppliers and they you can invent three available inventor not available for each of these cases you can still continue to supply but suppose you cannot continue supply then alternate routes are available alternate routes are available additional cost of transportation and so on the cost of shutdown so basically.

What I am saying here is that your manufacturing response depends on whether you can continue to supply to suppliers or you cannot continue to supply depending on the additional the this one here and there is the cost of shutdown cost of last sales cost of shifting production cost of additional transportation in all these but in all these cases so what I am saying here really if you map these diagrams then it becomes easy for you to see where your fault points are now.

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How do you create a resilient supply chain based on all the knowledge that we trained here.

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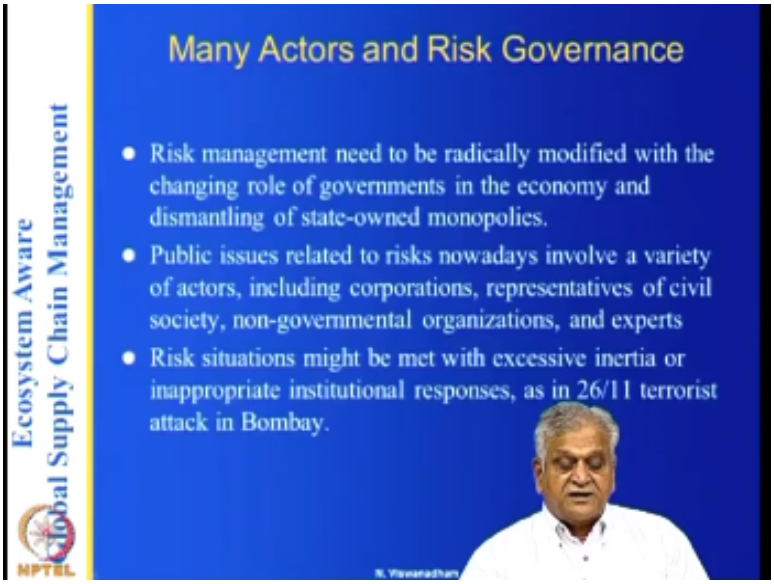

There are many actors risk management need to be radically modified with changing role of governments in the economy and dismantling of state-owned manipular now monopolist public issues related to risk nowadays involve a variety of factors including corporations representatives of the civil society non-government organizations and so on so all we are saying here is that you know we are having the issue of ecosystem.

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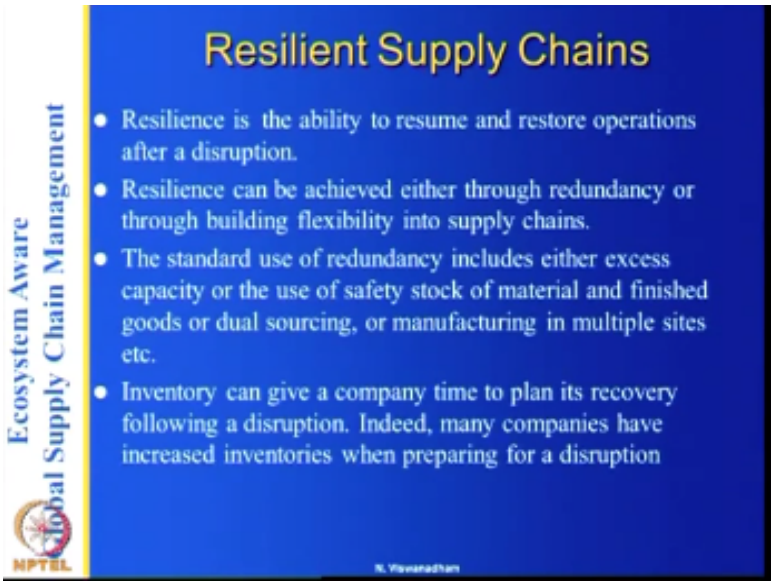

This one but what is religion and resilience is the ability to resume and restore operations after disruption this is like what I am saying that in genetic systems we are used to resilience in other words the system operates you go and the Pirates operates or you have a dual modular redundancy or triple modular redundancy in spite of the failure then the system still operates so is it possible to have resilience of this in the supply chains resilience can be achieved either through redundancy or through building flexibility into the supply chain.

We have seen in a in the case of example of a supplier failure if you have redundancy that is basically if you have inventory or a tool supplier then you could do it but you can also build flexibility into the sub standard use of redundancy includes either excess capacity or use of safety stock of material and finished goods or jewel sourcing or manufacturing in multiple sites so this is what we have seen in the in that example you have melt a safety stock and also a jewel sourcing.

You have another place where you can source it from an inventory can give a company time to plan its recovery following a disruption indeed many companies have increased inventory spent preparing for a disruption so inventory can give a company time to plan we have seen this in that supplier disruption example.

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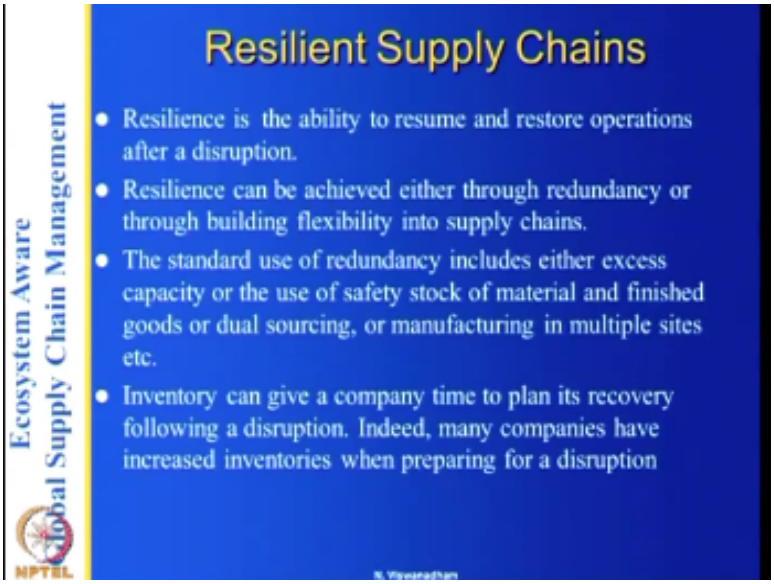

And in terms of flexibility to build flexibility in resilience for resilience companies must have all many facets of supply chain design should developing ability to move production among plants that is flexibility in other words you have two plants one in Singapore another in Eastern Europe if there is a problem in a store Oporto Singapore if there is a normal times you do it in Eastern Europe use interchangeable and generic parts of many products and cross train employees.

In other words you can basically interchangeable parts it is not have to be standardized parts but same power it can be used the power supply can be used and these things are generic designing products and processes for a maximum postponement as many operations additions are possible in the supply chain see this postponement is one of the things you postpone till the order finally comes so you design products so that you can postpone maximum of your things till the final order comes.

France rely on global shipments should build and support that can advise shifting delivery routes to different checkpoints if need based on the information at border crossing so before you ship you find out what is the situation at the Barossa browse the border crossing and find out instead of shifting to one location you can shift it to another ship it to another port and then truck it from there shifting one mode of transportation such as a threat to backup routes by another mode .

So in turn these stuffs may raise cause and affect production lead times and inventory levels well suffice it to say that both flexibility as well as the redundancy they cost money there is the ways in which you can create a resilient supply chain now but the other point is you need resilience or any reliability into your supply chain it is going to be cost costing money so you want to operate you want your system to operate even in spite of some other failures.

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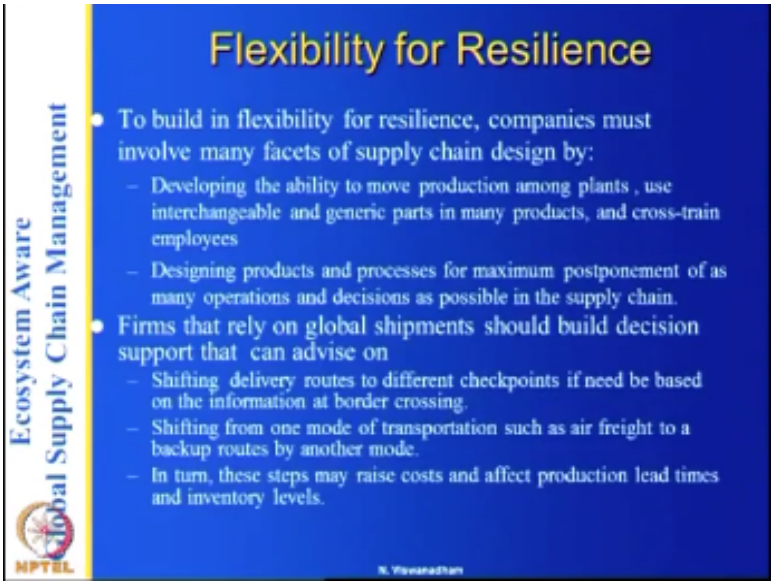

So if you want to do that you have to spend more money.

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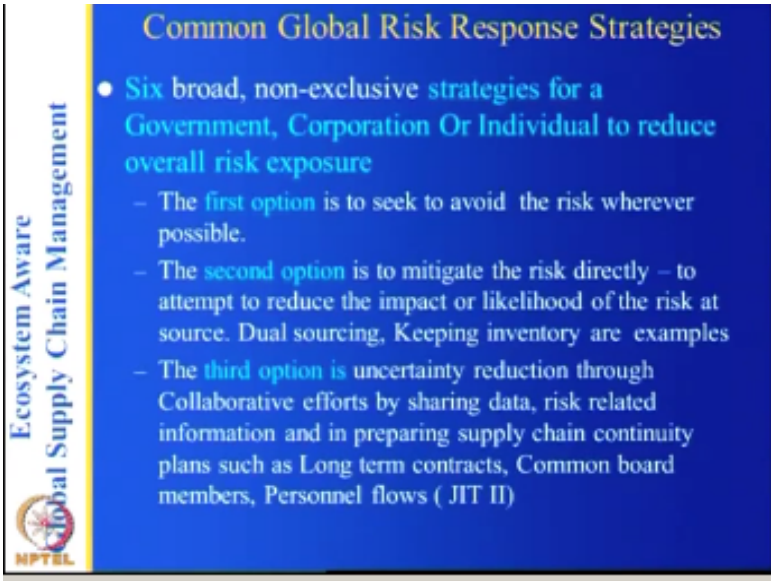

And so on so the carbon global risk strategies or the following six broad non exclusive strategies for a government corporation or individual who are the following the first option is seek to avoid the risk wherever possible you know stably do not go to the place where there is risk second option is to mitigate the risk directly attempt to reduce the impact of likelihood of the risk jewel sourcing keeping inventory or examples third option is uncertainty reduction through collaborative effects of sharing data risk related information and in preparing supply chain long term contracts and so on.

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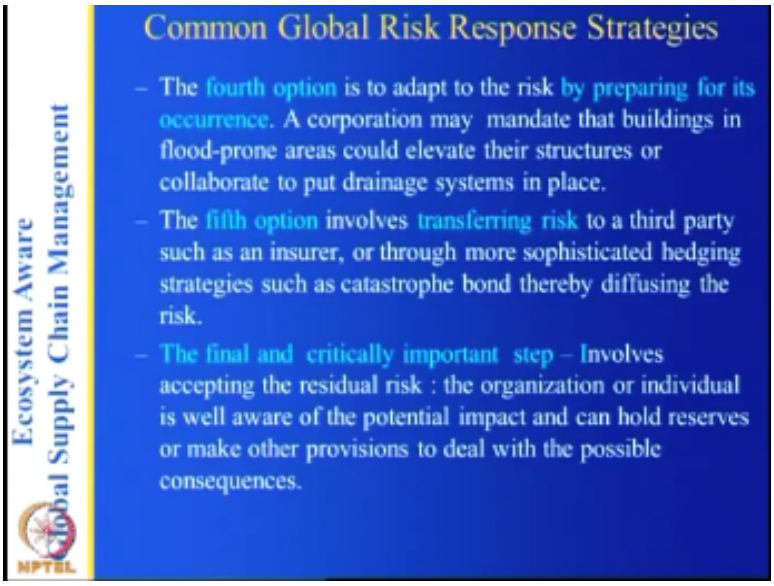

And fourth option is to adopt risk by preparing for its occurrence well this is like mandate that billing should be flood-prone we are elevate the structures and so on so you know that you are preparing for their occurrence the fifth option is transfer of risk by insuring through a third party and the final and critical option involves accepting the residual risk in other words in you know the risk is possible and the organization or individual is well aware of the potential impact and control results or make other provisions to deal with the possible sequences.

Now I let you know the risk say whatever happens or you take it further for this one so I am prepared I will spend this extra money to keep inventories to know whatever is this one so there is there is no other ways of doing it you have to I like you have a redundancy or flexibility or the ways to get at this one.

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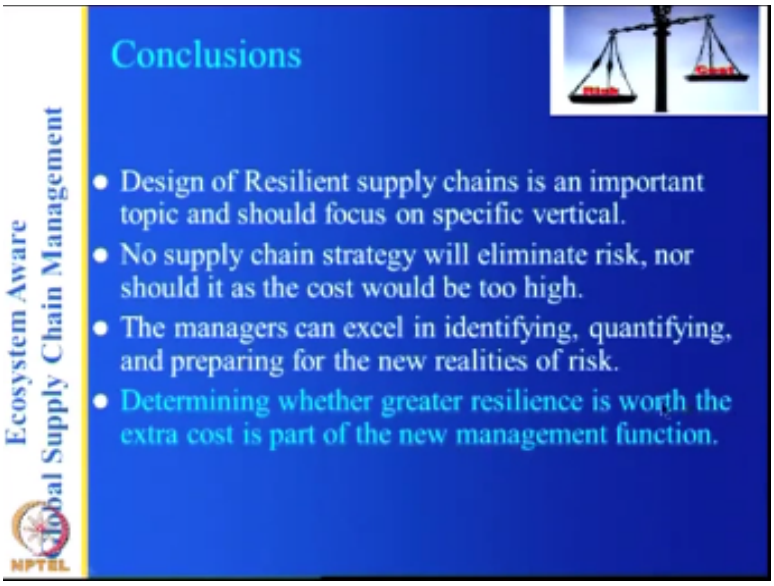

So what are the conclusion so you have to basically balance here your risk versus your resilience so design of resilient supply chains is an important topic and should focus on specific vertical so the conclusions that one gets are different for different verticals for oil and gas it is different from electronics it is different to for auto and so on no supply chain strategy will eliminate risk now should it because as the cost would be too high this is like saying that no humans no should not get a disease well you cannot make a human not catalysis.

The managers can excel in identify quantifying and preparing for the new realities of risk so this is one of the things because there is the unexpected risk and that is the expected risk this is unexpected risk this is it becomes a problem this is like somebody who has who is normal getting a heart attack then that is unexpected risk but somebody who has a blood pressure and diabetes getting a heart attack is an expected risk determining whether greater resilience is worth extra cost is a part of the new management function so the management needs to decide whether they need the extra this one or they do not want the extra you say so basically this is between the cost you spend to create resilience and with what you suffer the losses you make when the failure occurs.

So which one is the balancing act is the one that is a part of the management function so we suffice it to say that the supply chains are getting leaner and once they are getting leaner what

is happening in the supply chain literature is the global supply chains are basically more risk prone and there is several partners who are creating the risk from government social groups to the ports to the companies and the terrorists everybody so and the risk is becoming more soft oriented in other words is that your community race or cyber risk and so on which are difficult to do first in to find out that that is a risk and also later to mitigate this so the supply chain risk is a very important topic that is attracting the attention of people nowadays thank you.

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