Decision Support System for Managers
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Module - 09
Decision Support System for Distribution Network Design in a Supply Network
Lecture - 44
Risk Analysis for the Distribution Network

Hello and welcome to "Decision Support Systems for Managers"! We are into module 9 that is 'Decision Support System for Distribution Network Design in a Supply Network' and we are into lecture 4 that is 'Risk Analysis for the Distribution Network'; ok. In the first three, we have done first point in network designing: taxation advantage.

Second thing we learnt transhipment that is zero stop, how to model that; third thing we learnt flexibility touched upon Six Sigma; fourth thing we learned how to model flexibility and total cost in the supply chain, ok. Today we will learn risk analysis, and how it will impact my supply chain design; ok. So, let us move.

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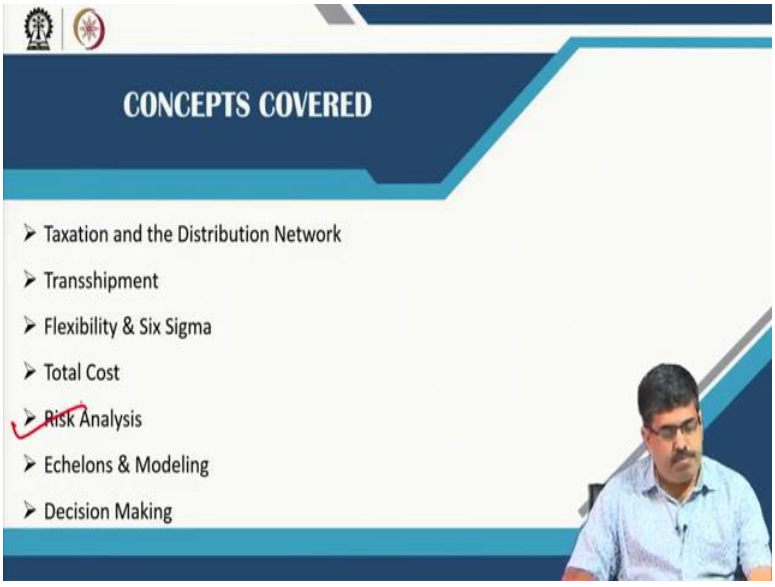

As we said, today we are covering this part; today we are covering risk analysis; ok.

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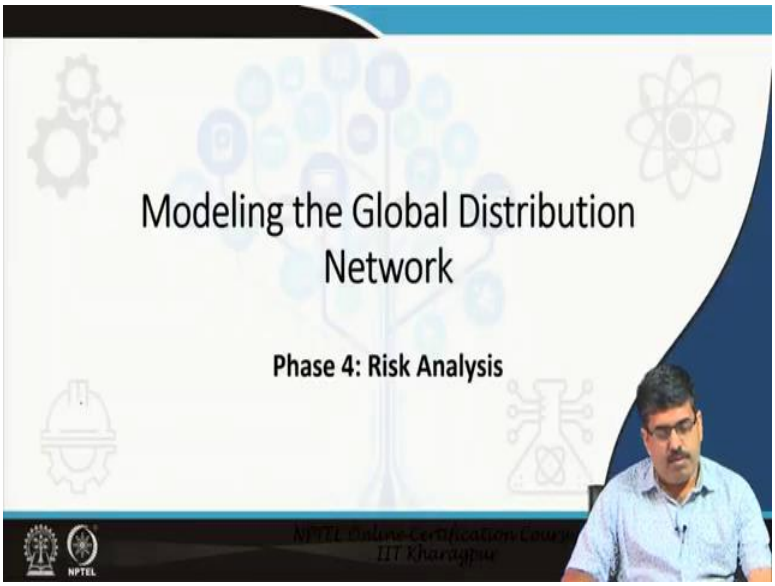

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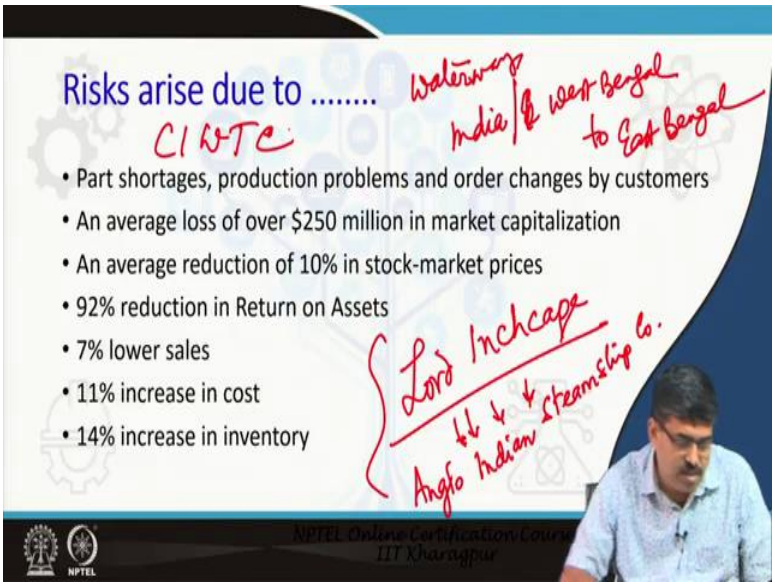

You know what is risk supply chain risk? Supply chain risk is a very-very great problem; I will give a simple example; ok. Lord Inchcape, I am not able to recollect properly, but the company that he owned was Anglo Indian Steamship Company; ok.

What this company would do? This company would take all cargo by water from India or West Bengal to East Bengal ok by waterways only; what am I explaining risk, waterways India, West Bengal to East Bengal; ok.

The first war with Pakistan, East Bengal means it was still being ruled by Pakistan. Only later on did Pakistan East Pakistan become Bangladesh right ok, were free Bangladesh ok. So, what happened during the India, Pakistan war, three consecutive wars first war. Most of these vessels were in East Pakistan, most of these vessels with cargo because that time water route was very-very easy and cheap; ok.

So, most of these vessels were inside East Pakistan and the war started, East Pakistan immediately confiscated all these vessels and said this is enemy property, we will not give it back. What happened you know, Anglo Indian Steamship Company had lots and lots of vessels I do not know remember the exact number, but lots; only two vessels were on Indian soil or Indian water, all were gone East Pakistan.

Anglo Indian Steamship Company did not get back anything, war ended, agreement, so many things, negotiation did it not get back. Why? Because East Pakistan that time ruled by Pakistani Government, they had lots of rivers. In fact, Bangladesh is a river and country, but they did not have these modern cargo vessels, so they purposefully confiscated it.

At the same way it is a win-win, because Lord Inchcape was trying to move out of India, because India had become independent; he did not feel like staying back, so he wanted to sell his business, but government said no, you cannot sell we will buy, you cannot sell to anybody we will buy. And government was giving very poor money, so this was a ploy also.

He because of his British alignment he knew very well, when will Pakistan attack; so, he purposefully ordered all his vessels to move with cargo inside East Pakistan. Now, the moment is vessels got captured by Pakistani army, because it was an East Pakistan side. Lord Inchcape wrote to the Government of India that look you told me not to sell, I have not sold my company; but all the vessels are gone you give me compensation at the market rate, because I need to buy new vessels.

So, the government had to give him compensation, he took the money and happily went back to England. What was left over of Anglo Indian Steamship Company? Only two vessels; so, government took it over took the company over and formed something called Central Inland Water Transport Corporation – CIWTC ok. So, this is what risk is, this is what risk is; ok.

Now, in supply chain setting risk is part shortage, production problem, other changes all these are risks. Risk lead to average loss of 250 million dollars in market cap. Average reduction of 10 percent in stock market price, 92 percent reduction in ROA, 7 percent lower sales very important. 11 percent increase in cost, 14 percent increase in inventory ok, risk is this data have been compiled over and over time.

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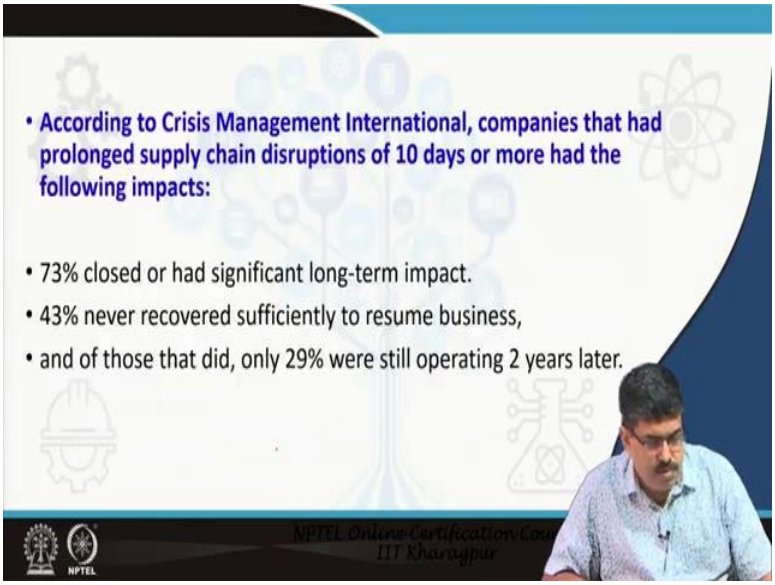

According to crisis management international companies are at prolonged supply chain disruptions of 10 days or more had the following impact. 73 percent closed or had significant long-term impact. 43 percent never recovered, and of those who did, only 29 percent were still operating 2 years later ok. So, supply chain risk is a great problem.

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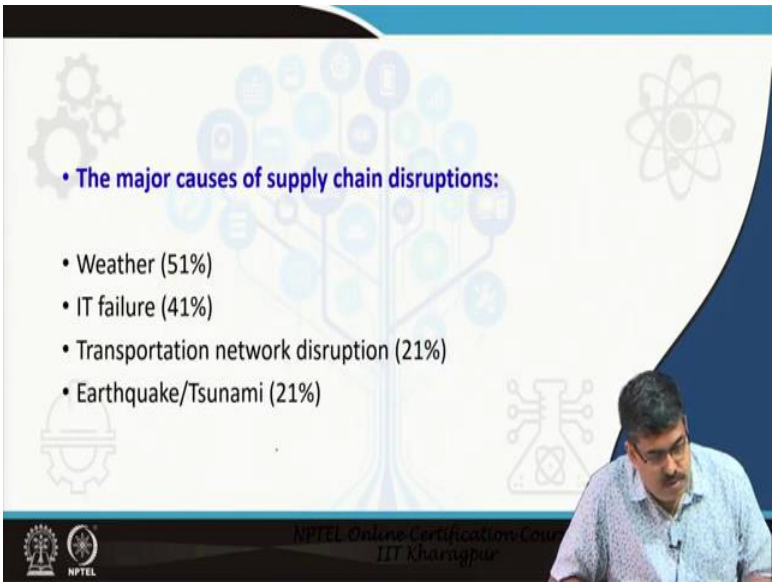

Major causes weather, most important. IT failure, person A's product going to person B, product in stock; but your computer system is showing no stock that is type 1. Type 2 error, computer is showing stock, but product is not there; nobody will believe, everybody will say computer is right. There is a product you do not know, but in reality the product is not there on the shelf at that time; ok, so IT failure.

Transportation network disruptions - any cyclone our planning for the coastal areas transportation planning and all disappears, gets disrupted. Earthquake, Tsunami we just mentioned 21 percent; ok. Transportation network disruption another is road blockages, any problem you come and block the road, so road blockages; ok.

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Now, where exactly the supply chain disruptions occur? 61 percent at tier 1 suppliers that means that the bill starting point ok, the most important one; 30 percent at tier 2, so 90 percent problem is solved; 9 or lower percentage at tier 3; ok, tertiary.

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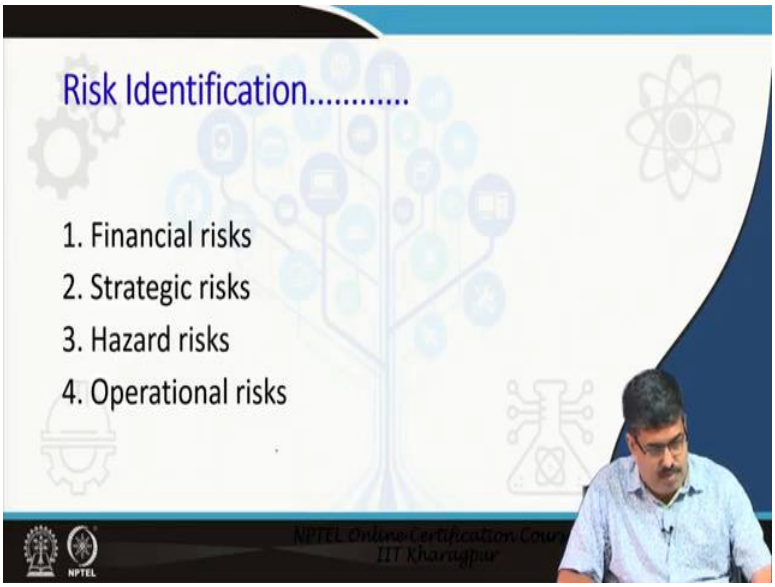

Now risk identification - financial risks, strategic risk, hazard risk and operational risk very easy, very simple; ok.

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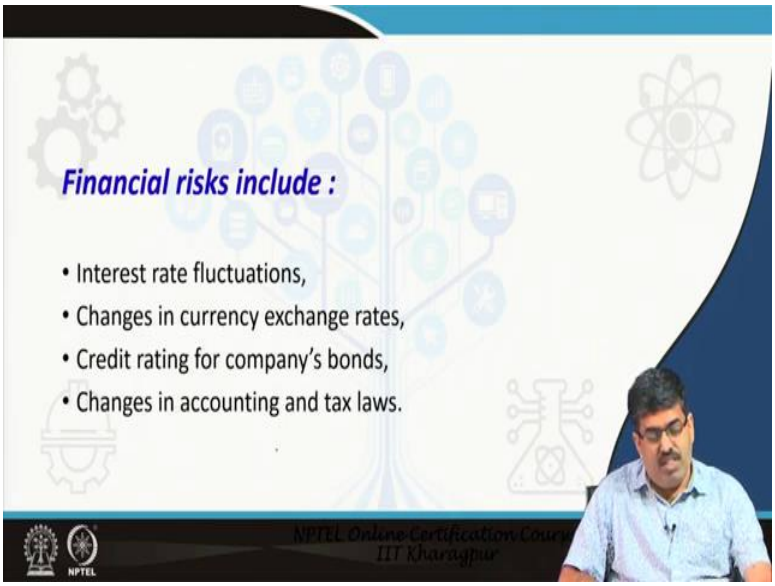

Financial, strategic, hazards, operations. Financial risk - interest rate fluctuations, changes in currency exchange rate, credit rating, changes in accounting and tax laws, I think everything is very common.

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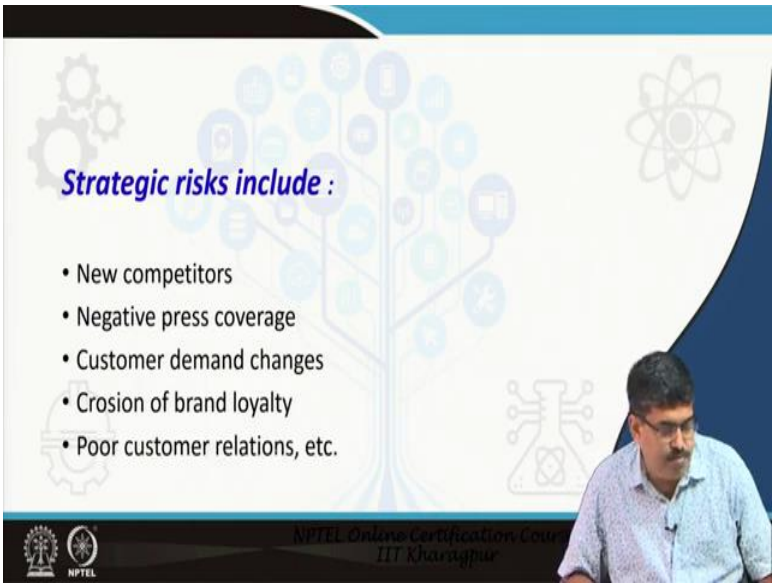

Strategic risks include new competitors, negative press coverage, customer demand changes, crosion of brand loyalty; ok. Strategic risk very-very important; long-term will damage your company; ok, new competitors you are not able to supply on time, because if a supply chain so new competitors have come.

Definitely negative press coverage – customer demand changes very-very quickly; how to model such a thing? Crosion of brand loyalty – because of all these, what will happen ultimately? Your brand loyalty will suffer; right; poor customer relations; right.

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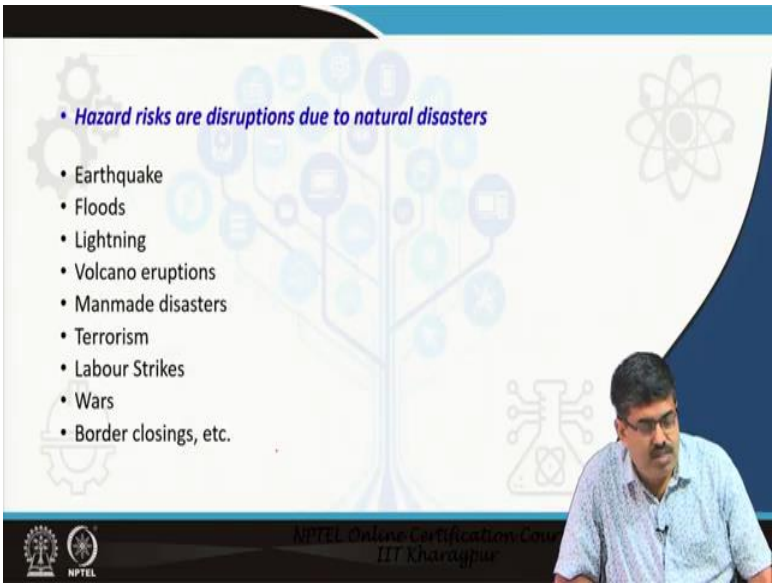

Hazard risk; the first one was what? Sorry; financial then strategic, then hazard, then operational; ok. Hazard risk is very something which you know; hazard earthquake, flood lightning, volcano, manmade disaster, terrorism, labour strikes, war, border closing, all hazards; we do not want this all hazards; ok.

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Operational risk – supplier problems, IT systems failure, computer viruses, product recalls, logistics failures; self-explanatory, not going into details; ok.

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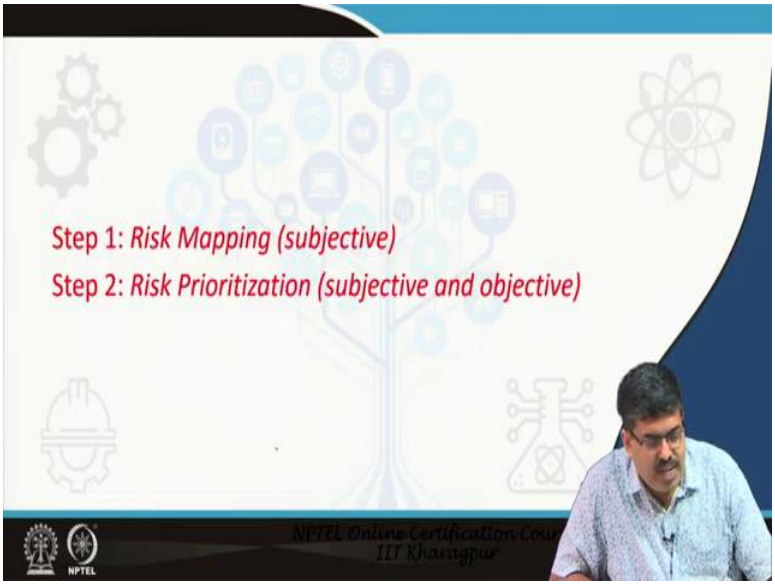

Risk assessment - risk mapping, risk prioritization. Risk mapping is a bit subjective have to put your own value judgments.

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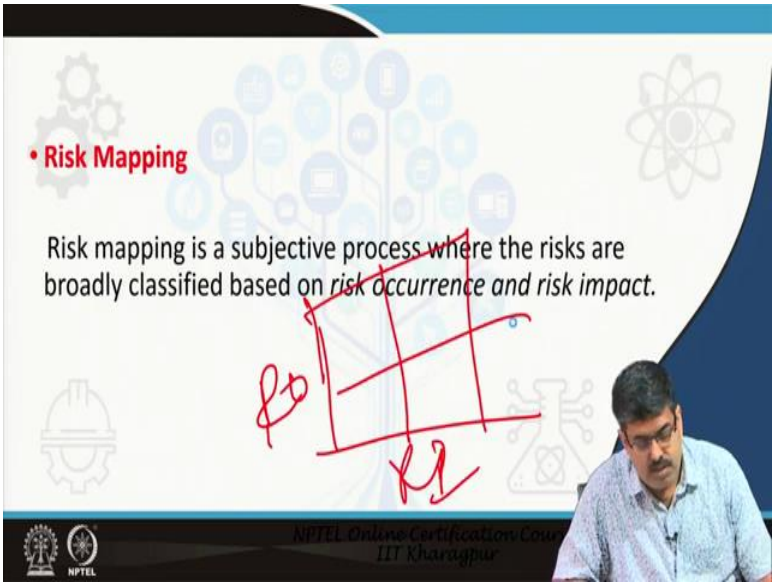

Risk mapping is subjective process where the risks are broadly classified based on risk occurrence and risk impact; so, based on risk occurrence and risk impact; ok, something like that; ok.

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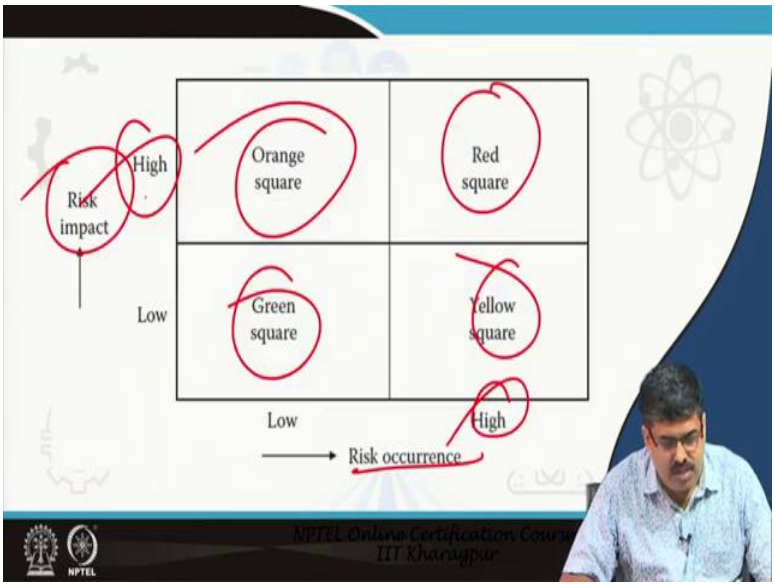

Yeah see risk occurrence, risk impact and make it red is high in risk occurrence and high in risk impact; ok; both are low get a green in between yellow and orange; ok. Now, if you see this red orange let me erase it; if you see this red and orange, etc., etc.

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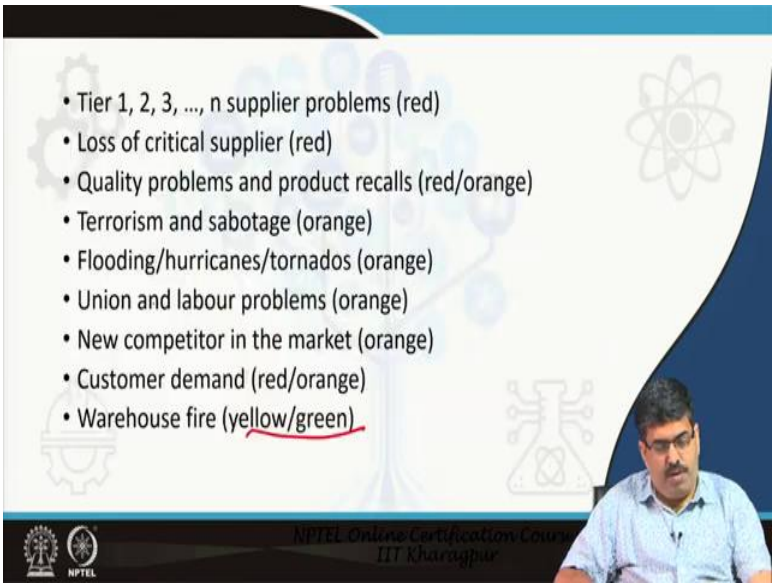

Tier 1, 2, 3 n supplier problems they are red; look at all the red all the examples of red, loss of critical supplier red, quality problems product recall if it is of the most important component, it is red; otherwise it is orange. Terrorism and sabotage orange, flooding hurricanes tornados orange, you know why these are orange?

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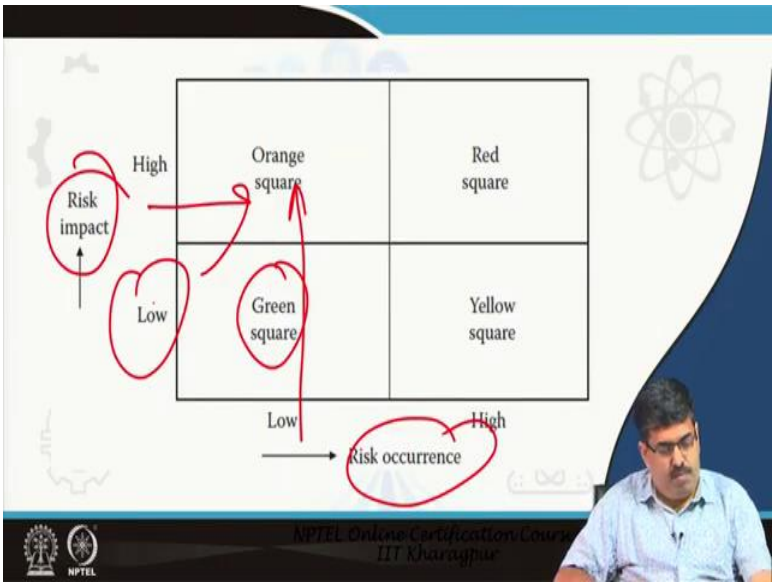

Because go back to the table, risk occurrence is low tornados will not happen every day risk occurrence is low, but the impact the severities very very high, it is orange ok. Union and labour problems again orange, new competitor in the market orange, customer demand red and orange, Warehouse fire yellow and green, why green warehouse fire?

Because anyway it is insured ok; see green warehouse fire all fire yellow or green right, risk occurrence is low we do we have not seen as such warehouse fires and risk impact is also low, why? Because insurance is done all the products, employees, everybody's insurance is ready; ok.

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Blizzard and ice storm not really in India, but abroad yes. IT systems failure yes, orange. Logistics provider failure yellow, equipment breakdown green, product returns from customers' green, temporary work stoppages yellow.

Is it these are all the risk classifications based on the severity, you can look at those matrices and do this as an exercise also, you can put press your hand on it just, so that you do not see it and then you can practice it.

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Risk prioritization ok, first risk mapping, next is see risk mapping and risk prioritization right. So, what we did here, we did risk mapping; ok.

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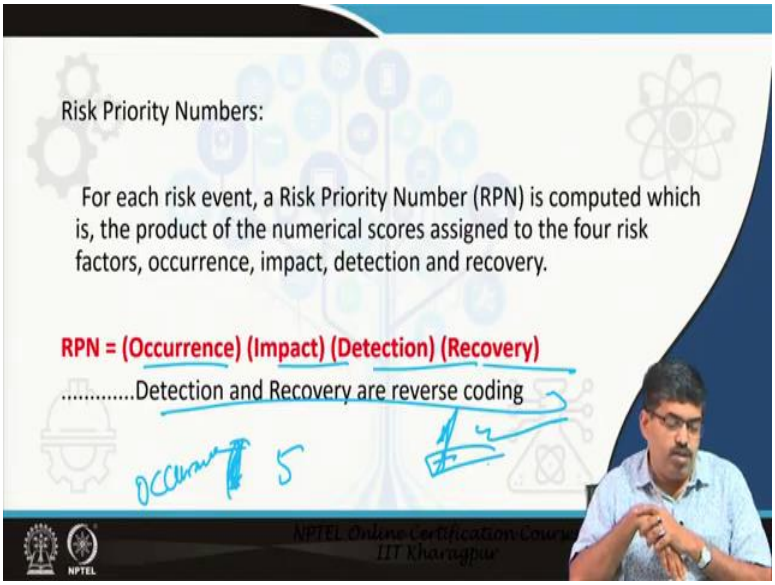

Next is risk prioritization - for this we generate something called a Risk Priority Number – RPN. This RPN is equal to RPN is equal to occurrence impact detection recovery, detection and recovery are reverse coding means; if 5 is high 5 is highest for occurrence, for recovery it is 1, ok; for recovery it is 1 that is what we mean by reverse coding, and they have to be reconverted or the wordings of the questionnaire are to be changed, but it is not done they are to be converted; ok. So, occurrence impact detection recovery.

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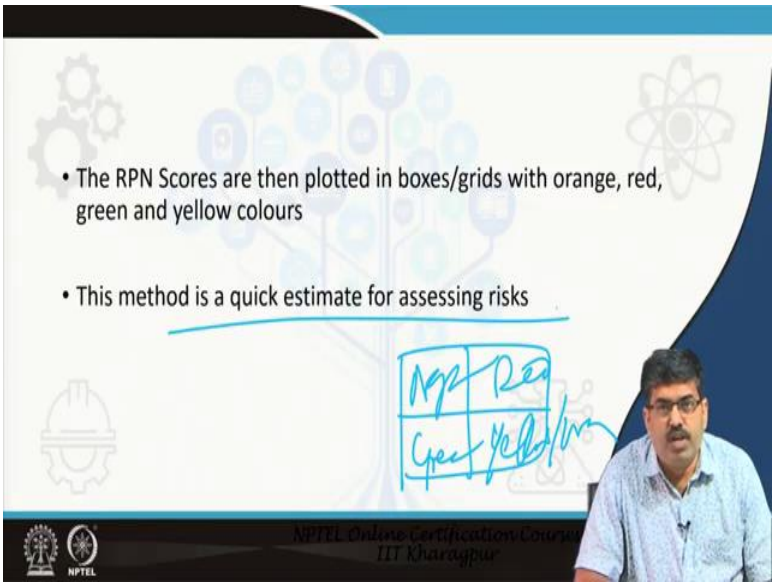

The RPN scores are then plotted in boxes grids with orange red green and yellow numbers, as we have seen this method is a quick estimate of assessing risk. This is red, yellow or orange, this is orange; ok; so this method is a quick estimate for assessing risks.

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What are the models that are available? The Value-at-Risk model, Miss- the-Target type risks and risk is a function of impact and occurrence; ok.

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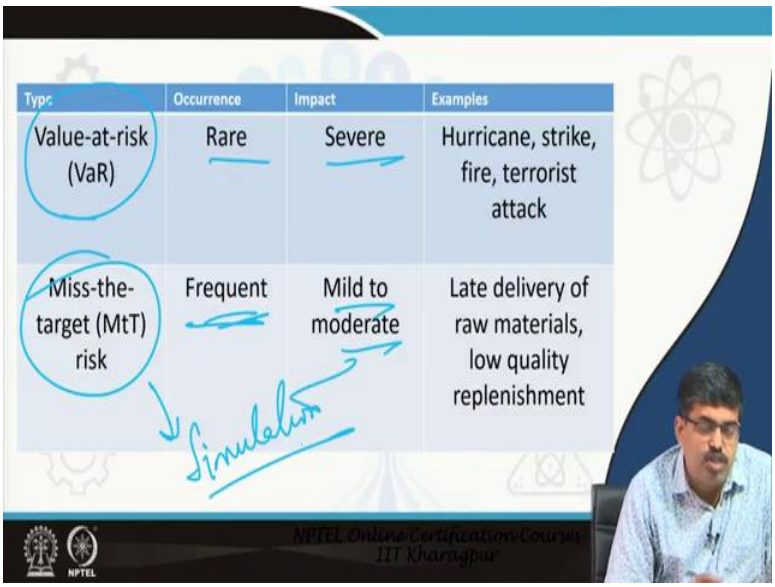

Let us see the VaR model and the Miss-the-Target risk, VaR models used when the risks is very rare as well as very severe. The Miss-the-target means frequent and mild to moderate, it is like the summer storms during the summer months ok; Rare and severe Value-at-Risk hurricane, strike, fire, terrorist attack, etcetera; Miss-the-target late delivery of raw materials, so the magnitude is much less, low quality replenishment; ok.

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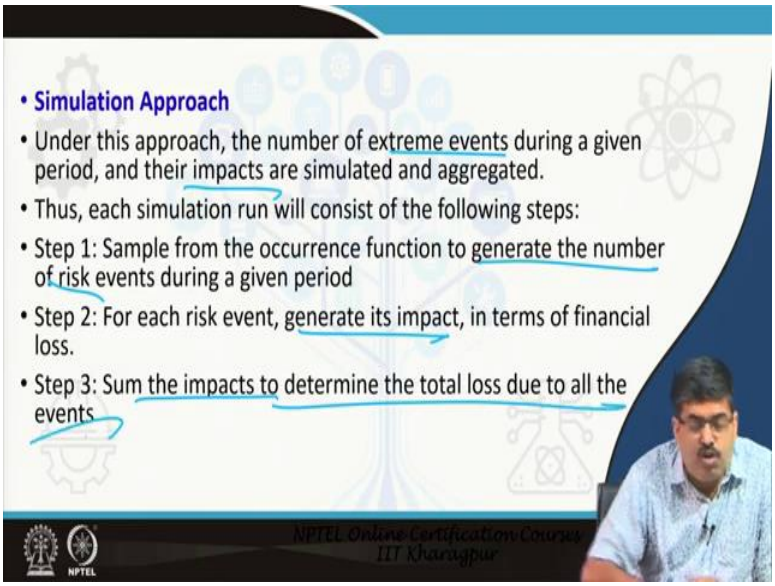

Simulation approach for risk under this approach, the number of extreme events during a given period, and their impacts are simulated and aggregated; extreme events and their impacts. Each simulation run will consist of the following steps; sample from the occurrence function to generate the number of risk events during a given period; ok; simulation, we do number generation.

Step 2, for each risk event; generate its impact, in terms of financial loss. So, first is generate the number of even risks, next is generated its impact and third is sum the impacts to determine the total loss due to all the events; ok.

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Measuring risk – political, macro, social; input these are social; sorry, social input market.

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These are all your some sort of a PESTEL framework that we do in strategy but yes indeed they are measurable. This is another way by which you do it fragile state index and global peace index; they also give you some idea about the risks of different countries; ok.

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Global competitiveness index is another one; ok. Is there again sum? No, vendor fail risk, this is another one.

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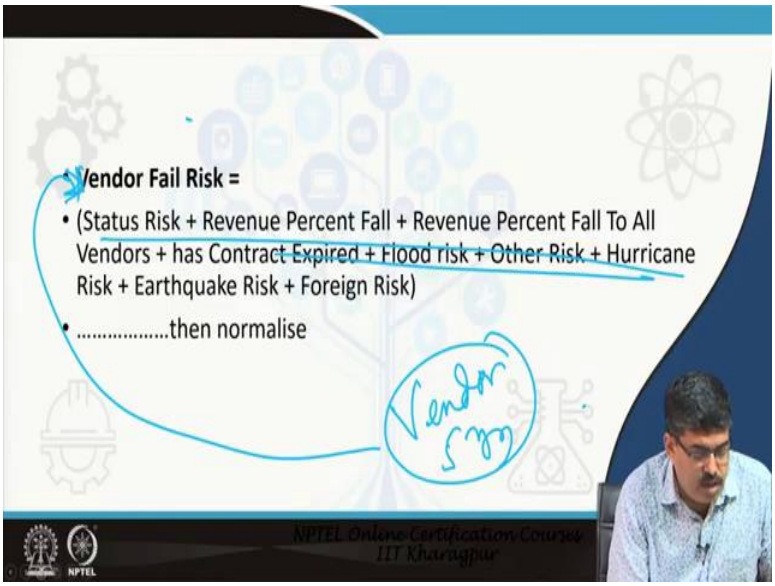

Risk is fine, this vendor is also working with me for 5 years, but what is this vendor fail risks? It is a summation of all these status, revenue, revenue fall vendors, contract expired; sorry, has contract expired everything; ok; flood risks, other risk, hurricane risk, earthquake risk, foreign risk; ok; so, all these are a part of vendor fail risk; ok.

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System impact risk product is non-repairable, sole source, technical product risk; ok. The now if you see these are all different dimensions, these are all different units, so you have to normalize; you have to normalize; ok; that is system impact risk.

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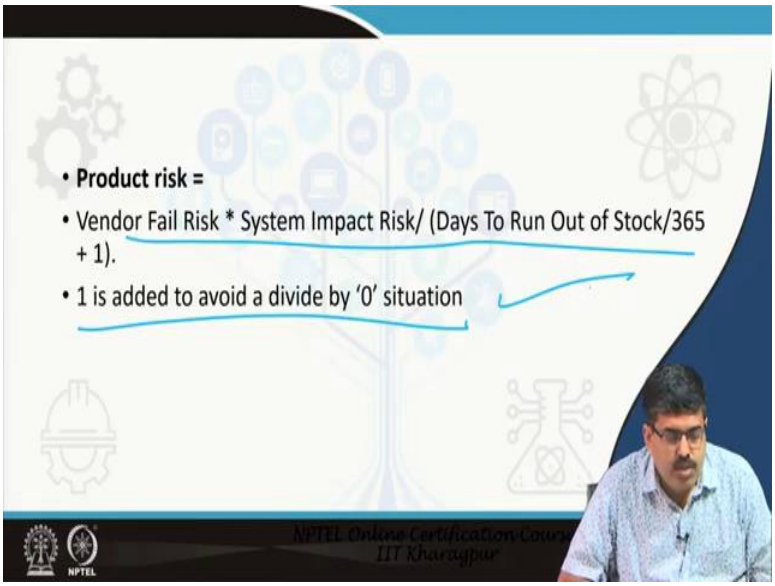

Product risk - vendor failed risk into system impact risk divided by days to run out of stock divided by 365 plus 1 ok that is vendor fail risk, because vendor is failing. Now, 1 is avoided to have due to avoid a divide by 0 situation; ok; here that is product risk.

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So, if you see Miss-the-target risk, the mean and standard deviation comes in handy to conduct simulation analysis ok. So, our this thing was if you remember, Value-at-risk and Miss-the-target risk; Miss-the-target risk frequent so when it is frequent, so you can do a simulation ok, and this is the Miss-the-Target risk.

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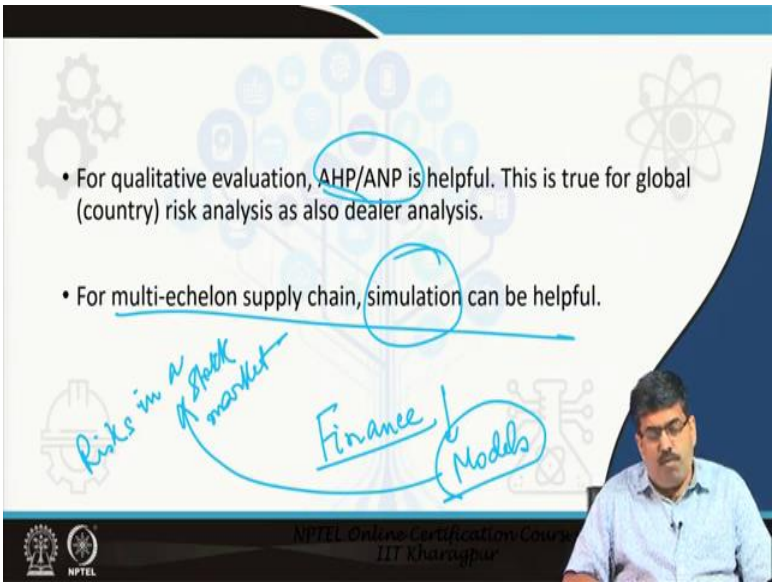

For qualitative evaluation, AHP, ANP is helpful. This is true for global country risk analysis and also dealer analysis ok. For multi-echelon supply chain, simulation can be helpful; ok. So, I would suggest that you have some homework done on simulation studies, and also you learn AHP and ANP; ok, it is very easy, very-very easy; do not get afraid by software, etc.; it is very easy; ok.

So, for multi-echelon supply chain as I would suggest, you study simulation a bit and I would also suggest to study AHP, ANP that will help you; ok. AHP, ANP is also very easy; ok; there will be courses where you will learn AHP, ANP; ok.

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Now, these are the references; risk is pretty much research paper based study ok and this is pretty much the way you measure risk ok, now this is one aspect. The second aspect is people who are having a finance background, in finance there are lots of models that predict the risks in a stock market ok, you can adopt those models if you see there some model it is relevant here.

In fact, the models that we said all are majority of them adoptions from these risk models. So, so if you look at a risk model, you can adopt a financial risk model here also; ok; so that also you can do; ok. So, overall supply chain risk is a great problem and we all know the stories of Idi Amin, etc.

India doing a lot of business and then one fine morning, they are asked to evacuate; ok. So, risks in supply chain is great, certain routes we would love to have, because a very low cost very short distance, but situations do not allow us. For example Afghanistan, we will love to have a products via Afghanistan from the Middle East; but then international and country risk does not allow us to do that; ok.

So, there are lot of risks involved in supply chain and you should be very-very careful on how these risks are getting mapped; ok. So, this is it and as I mentioned, these are the references for this; ok. And this Chopra and Meindl has very decent references, chapters on risks. So, yeah we will end the lecture here; next class we will go ahead with the last lecture of this module of supply chain design; ok. Thank you!