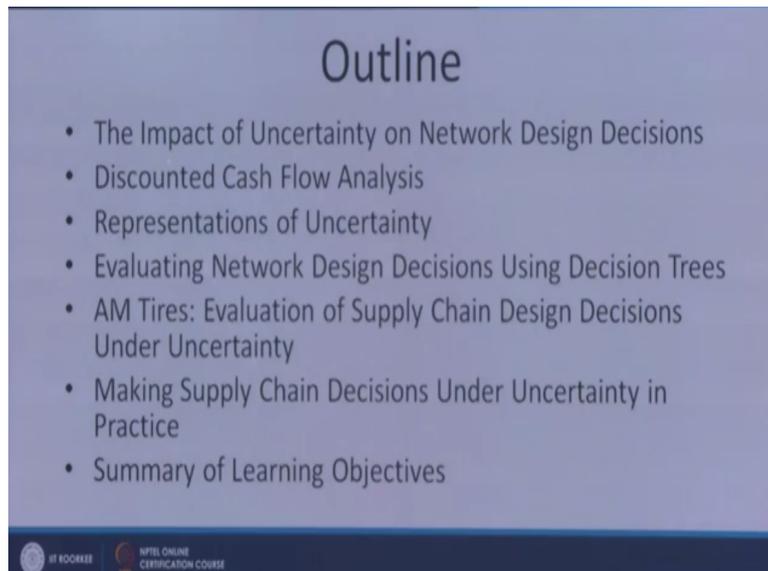


Supply Chain Analytics
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Lecture-29
Network Design in Uncertain Environment and Flexibility

Welcome back and in this course of supply chain analytics in this session we are going to discuss the network design in uncertain environment. Nowadays with know lot of type of uncertainties are there in the external environment and time and again we have discussed the importance that we need to have a supply chain which is adaptive to these changes. So in this session with respect to network design that how can we make those types of network which can handle uncertainties of the external environment.

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So the outline of the sessions are we will be discussing this in next two, three sessions and the impact of uncertainty in the network design, then we have different types of project options and for that purpose we will see the role of cash flow analysis for selection of a particular type of projects for the network design with the help some uncertainties we will see that how to make the mathematical model for making the optimum price.

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The Impact of Uncertainty on Network Design

- Supply chain design decisions include investments in number and size of plants, number of trucks, number of warehouses
- These decisions cannot be easily changed in the short- term
- There will be a good deal of uncertainty in demand, prices, exchange rates, and the competitive market over the lifetime of a supply chain network
- Therefore, building flexibility into supply chain operations allows the supply chain to deal with uncertainty in a manner that will maximize profits



And to start the discussion of uncertainty in a network let us see what are the different type of impacts uncertainty can create in a network design. Now supply chain decisions there are different type of design decisions and some of the decisions which are short term which are intermediate term and which are long term. When we are talking of network design these are long term decisions.

And these decisions include investment in number of and the size of the plants it is related to number of transportation facilities like your trucks, lorries, trailers etc. then the number of warehouses. All these all these decisions where huge amount of capital is required, so therefore issues related to cash flow analysis become important in handling this long term decisions because of the amount involved in this things.

This decisions cannot be easily changed in the short term, you are making a warehouse in Punjab and now another day it is almost impossible for you to shift that warehouse from Punjab to Gujarat, so these decisions are very long term decisions and you need to be very careful in selecting a particular location, the same thing is with the site also, you need to consider the demand for long period of time.

And accordingly you need to see that what should be the optimum size of those facilities, warehouses, your plants, your trucks etc, and therefore many time you may think as a solution strategy that we do not build these resources at we try to outsource many of such resources because if you put your money it will be very difficult and in this session itself we will see that how to minimise our investment in these issues.

So that you have flexibility in dealing the uncertainty of the environment, so we cannot change this decision in the short term, then there will be a good deal of uncertainty in demand, demand is highly uncertain, demand is highly uncertain nowadays and it is very very difficult for any kind of mathematical model to determine when a Black Swan will come and therefore demands are highly unpredictable.

We use good forecasting, we have already discussed in our earlier session about various forecasting techniques where we try to model different type of characteristics of our demand data but even then you will have some situation because like for example disasters you have situations of disasters where all of a sudden demand of a particular product may increase, in last year during the time of Deepavali we have discussed that because of pollution in NCR and the demand of mask.

So that you can be easily with that increases to a very high level and that was highly unpredictable there was no mathematical supposed to that type of increase in demand, similarly in many other area of country different type of phenomena take place and accordingly demand of some of the production may increased to a very high level demonetization happened and as a result of demonetisation demand of various products decreased to a very low level.

There is a plant of one of the largest two wheeler manufacturer in Uttarakhand and that plant remain closed for more than one month because there was no cash available in the market and as a result of that demand of that product went to a very low levels, so these are uncertainty with respective demand and these uncertainties are continuously increasing and we all know about this VUCA and because of VUCA we have more confidence in present environment with respect to demand.

Then you have prices also because of a lot of globalisation, because of a lot of international issues we have seen that there was a time when the prices of crew increase to as high as 140 dollar per barrel and it decrease to as low as 20 dollars per barrel. Now this huge shift of price include created a very volatile price sensitivity to the commodity prices also, so you are also very much uncertain about the prices related issues also.

And certainly these price related issues will create impact on the supply chain. Because you have developed the supply chain to a particular level of final price end price, but you see because all of a sudden the raw material price has increased, all of a sudden a new competitor has come to the market we have a very good example in this particular case, there was a very sturdy mobile service market in India.

All of a sudden Reliance Jio came into the market and Reliance Jio started offering 4G services at a very low price and initially without any charge it was always free and you can use as much as like and now they have also extended the services to 31st of March. Now at this type of competition when Airtel was there, where Vodafone was there, BSNL was there, Idea was there and all of a sudden Reliance Jio came and started giving services without any charge.

So this type of price uncertainty creates a huge amount of pressure on other competitors and nowadays this uncertainty is again increasing because many competitors, many companies when a service provider does many marketers they try to compete on the basis of low prices, so price uncertainty is also impacting our supply chain decisions to a great extent, then exchange rates international environment is creating a lot of fluctuations in the exchange rates.

The dollar versus rupee price, dollar versus pound price, pound versus rupee price, euro versus rupee price, all these situations are happening almost on the daily basis and because of these uncertainties our Global trade and not only Global trade because we are living in a globalised economy our internal trade is also getting affected because some time it is cheaper to import from Europe, sometime it is cheaper to import from UK, sometime it is cheaper to import from USA.

So now when you have different countries giving you different types of cheaper products, so you cannot have one single source of supply for your supply chain, you need to develop your suppliers in USA, you need to develop suppliers in UK, you need to develop suppliers in Europe and maybe in Southeast Asian countries also, because exchange rate will create a pressure on you to always look for cheaper sources for your raw material, cheaper sources for your other kind of some components etc.

So and it also creates a pressure on you because if your currency becomes dear, if you are currency becomes strong, so imports from your country, import from your country to other country means your exports will be costlier, so you may lose your market in that case, so there are uncertainties with respect to exchange rate and these uncertainty is may help, may create pressure you can find more cheaper sources of raw material or your exports may become costlier.

So both these things are possible and therefore we need to have power supply chains adaptive to these changes also. Then the competitive market over the lifetime of a supply chain network, the competitive markets are also changing, new market for emerging and old market are dying, you have a very interesting situation when one digital camera was competing with another digital camera, but nowadays digital camera is competing with a mobile phone.

Because mobile phone is also offering a very good camera options and therefore you have new competitive markets, the uses of mobile phone they are the competitive market for the digital camera, so these type of changes are also happening in the supply chain, so new types of markets are emerging, we earlier had the news papers printed on papers but nowadays all those news feeds are available in our mobile phone.

So now the news paper market is competing with the mobile markets, the application market and therefore new types of competitive market are also coming in the lifetime of a product and you have to be competitive you need to understand the impact of these things on your supply chain, so you can get uncertainty from demand, you can get uncertainty for the prices of your raw materials, prices of the labour, prices of the machines, prices of the market.

You can get uncertainty from the exchange rates you can get uncertainty from the different types of competitive markets, another interesting example of the competitive market in some of the cities we see that Local boys are doing deliveries for pizza or other food items and now companies have these type of policy that they will deliver within 20 minutes of your order 30 minutes of your order and these delivery boys are very much expert in knowing the shortest route to deliver a product to a particular destination.

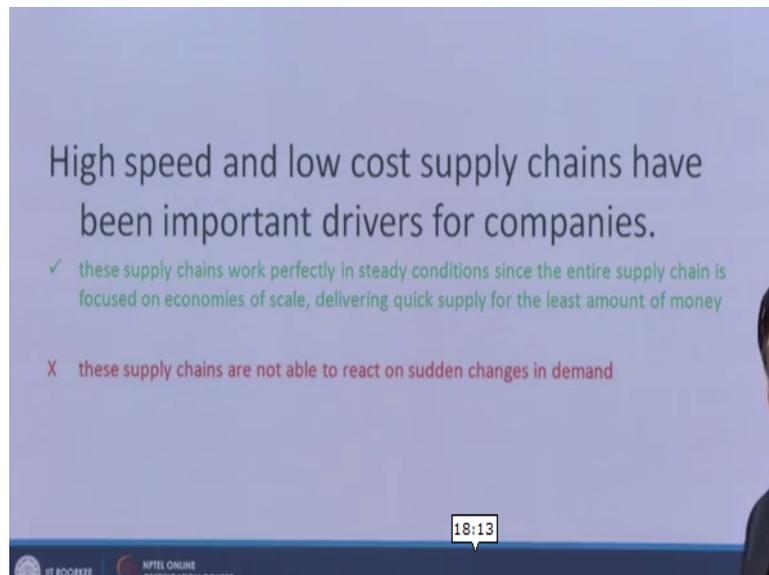
Now most of the E-Commerce companies are trying to hire this delivery boys so that they can also use their expertise in using the shortest route to deliver the product and therefore this is

giving a good amount of uncertainty to those retail food joints those were involved in the delivery to the door step of the customers, so these types of uncertainty who can think of that a delivery boy delivering the pizza can be a very important source of uncertainty.

Because he can be hired by some other E-Commerce portal who is also involved in delivering the products to the customer, so these type of uncertainties are always happening and we need to be very much adaptable to these types of challenges. So what is the solution therefore we need to build flexibility in to supply chain operations. Flexibility is said that one key answer for handling the uncertainty is in your supply chain.

Your flexibility in the supply chain operations allows the supply chain to deal with the alkalinity in a manner which can maximize our profit, uncertainties are bound to increase, so you cannot control these uncertainties because these are coming from the external environment, now other effort only be directed to align our supply chain, our supply chain operations to match these uncertainties and for that purpose flexibility is considered to be the keyword.

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This flexibility is considered to be the keywords that if we can build flexibility in the supply chain, this will help us to handle the uncertainty the impact of uncertainty in this supply chain. Now building on this idea that we need flexibility in the supply chain, if I see the traditional role of supply chain, we have gone through so many sessions of supply chain, but if I want to summarise the supply chain.

So the traditional role of supply chain is we want high speed of delivery, the product can be delivered to the customer with minimum time and low cost. The cost of delivery should be as low as possible, so we want higher speed and lower cost, that is the supply chain for most of the companies. The meaning of supply chain management is these two words, we want higher speed of delivery and lower cost of delivery.

However, there is a contradiction in this menu office may feel that as we increase the speed of the delivery as we want faster mode of delivery, if I want to deliver a letter through rail the cost will be less and if I am delivering that letter using aircraft as my mode of transportation obviously the cost will be more. So I need to find some kind of optimum balance between these two things that I can achieve a moderate level of speed and a reasonable cost to achieve that level of speed.

We have already discussed this under the responsiveness and efficiency spectrum where how to achieve the balance between speed and cost was discussed in detail. So it is just to understand that these are the two important drivers for supply chain for a company highest speed and low cost. Now it is high speed and low cost, these things worked perfectly fine in a supply chain which is operating under study state conditions.

Where you have less uncertainties where you have every 6 types of environment, in those situations this high speed and low cost can work well, when you have study conditions, study condition means that conditions are not changing with respect to time, though conditions which with respect to location, these conditions may be different in Japanese market, these conditions may be different in European market, these conditions may be different in Indian market.

So these things are possible, so study base with respect to time, those conditions which were there in India 3 years back the same conditions are there today also and same conditions will remain after 4 or 5 years, those conditions were there in the European market, these conditions are there today also at after 4 years also the conditions will remain as it is. So steady condition there are two meanings, one is with respect to time, one is with respect to location, here I mean is with respect to time.

So at a particular location with respect to time, the conditions remain same whatever level of demand is there it is almost constant or it is having a particular type of trend which you can easily model, if there is a seasonality in the demand you can easily model that seasonality in the demand. So whatever type of characteristic is there in your demand data you can easily make a pattern of that characteristic.

Whatever is the fluctuation in the price you can already predict those situations and accordingly you can take the decision, so study conditions are as per the time at a particular location and in this case the entire supply chain is focused on Economy of scale that is to achieve the low cost, economics of scale is linked to the low cost, so you can plan what should be the optimum size of your warehouse, you can plan what should be the low size in a truck.

All these things what should be the optimum best price of production, what should be the optimum quantity you should procure at a particular time POQ, all these things will help you to achieve economies of scale which is directly linked with the issue of low cost, then delivering quick supply for the least amount of money, delivering keep supply means you know how to change products from one place to another place because you have a very routine pattern of demand.

So you can achieve the high speed also, so this economies of scale and delivering quick supply these things will help you to achieve both these things higher speeds and low cost in a steady state condition where much fluctuations are not there. But what we are discussing this is not possible because if changes are sudden in the demand then it is difficult to achieve high speed and low cost, because to meet this changes if demand increases all of a sudden.

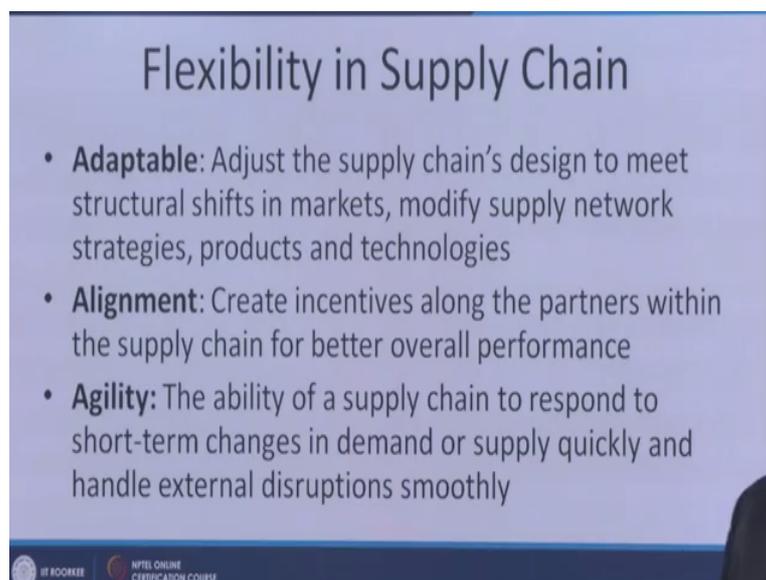
So you need to go backward into your supply chain, so that you can fulfill the additional demand you may subcontract, you may give overtime to your workers or otherwise some backlogs will be there, if the clocks are there you will incur extra cost, even in the case of overtime, even in the case of sub contract your cost of offering the product will increase, so when the changes are sudden in the demand, in the prices, in the exchange rates.

All the sudden changes will be a challenge to achieve higher speed and low cost, so therefore it is important to understand the role of flexibility and flexibility is as we discussed is one of

the key answer to handle the problem of uncertainty in your network design, now what do we mean by flexibility in a surprising it is very important to understand that what is the meaning of flexibility.

You will go to Google and you will just type flexibility in supply chain thousands of answers will come in front of you defining flexibility in supply chain, now to explain flexibility in supply chain I take the help of one of the article published by Lee in Harvard Business Review in year 2004.

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Lee published this article in year 2004 and on the basis of that this article we have these three important meaning, three important dimensions of flexibility in the supply chain, these are supply chain should be adaptable, these alignment is the another important dimension and agility is the third important dimensions for achieving flexibility in the supplies. Now let us discuss meaning of these three things one by one.

Adaptable means the supply chains should be able to adapt to the changes, you need to make changes in the real time and here comes the role of our supply chain analytics, the art of analytics where we are doing the predictive modelling, these things will help us in making the supply chain adaptable at the real time, you are not taking decisions based on some data of 1847, y may decisions based on real time, what is happening today.

Unfortunately IT is a very important enabler which is helping us in making our supply chains more adaptable with the real time happening, things like POS point of sales data these things

will help us a lot in future about making real time analysis, so adaptable supply chains are 1 important dimensions of flexibility in the supply chain, what is the meaning of adaptability me at the store supply chains designs to meet structural shifts in market, modify supply network strategies products and technologies.

We are able to make changes in our supply chain with respect to structural shift in the market modify supply network strategies and products and technologies, now give example how you can achieve the adaptable supply chain. In India we used to have brick and mortar stores for most of the products, most of the products we go to the market, we have cash in our hand or cheque in overhead and we go we select a product pay the price of the product and purchase it.

This is what the system used to follow, but last few years we all have seen that how different E-Commerce portals have come to the market and because of that many of us have started the convenience the better shopping experience shopping at your time and the variety, the discounts so many different factors are there which are helping in improving the performance of these E-Commerce portals.

So now the market structure is shifted, we are continuously talking about how to eliminate the middle man, so the role of middle man we do not want in the supply chain and in this changing scenario when the structures are shifting, now these middle men have also started offering the special services through E-commerce and this is a good example that how you can be adapting yourself to the changing requirement.

Because more and more literature you will find more and more discussion you will find and in almost all the discussion they personally I believe that middle men are very important element in a supply chain but the literature the discussions they are always against middle man, they say that middle men take survey most of the profit of the supply chain and particularly when we talk of food products, when we talk of Handicrafts, when we talk of products coming from micro small enterprises.

In these cases we are highly anti to the middleman and therefore if a supply chain which is very much dependent on middle man and the structure is changing and when organised retail is coming when organised activity what happening so those middleman need to adapt

themselves to the changing market structures. Otherwise, they all will be out of the market because most of the discussion is happening about how to eliminate the middle.

So this becomes a very good example that if you are adaptable to these changes you will survive, if you are not adaptable to these changes we will not be able to survive in this changing structure of the market. You need to modify your supply network strategies, we have discussed the example of Dell in earlier classes and it is important to discuss the same example in this class also.

That when Dell found that customers are not ready to wait for the product because the orders are not very specific, almost similar type of orders were coming from different customers so, Dell immediately change their supply network strategy, then it started the retail supply of the product, earlier it was only through special orders, but after that Dell started retail distribution of the product.

So Dell became adaptable to changing situation of the market, so you need to be adaptable to the changing market structure, you need to be adaptable to the changing supply network and all those things which we require that how you take changes positively into your supply chain, so this is the first important aspect of flexibility in the supply chain. So we stop here in the session, we will continue with the same topic and will see other elements of flexibility in our next session. Thank you very much.