Logistics & Supply Chain Management

Professor Vikas Thakur

Department of Humanities & Social Sciences

Indian Institute of Technology, Kharagpur

Lecture 26 : Supply Chain Uncertainty and Processes

So, hello dear students. Welcome back to NPTEL online course on logistics and supply chain management. I am Dr. Vikas Thakur, Assistant Professor, Department of Humanities and Social Sciences, IIT, Kharagpur. So today in this journey, we'll discuss today about some of the challenges which maybe a supply chain manager will face in terms of uncertainties, which may be posed from the customer end where we are consuming the final product, or maybe it can come, these uncertainties can be from the supply end. So complete supply chain perspective, we'll see what are the different challenges in terms of uncertain situations which we are put into and then how we can deal with those some of the mitigating strategies we will discuss right and then we will talk about again the supply chain macro processes keeping three stakeholders in mind first is your supplier then manufacturer and then the customer So, among the interaction, if we will talk about among these three stakeholders, we will see what are those macro processes we are handling when we are talking about the complete supply chain management as macro processes.

So, if I will just randomly ask you, about any if you are supply chain manager and we are asking about when we will replenish the inventory right may be on the road you are having all the data stats with you that may be 5 lots are coming from different suppliers right if I will ask you the exact location may be you can specify the exact location where are the goods right now, but if I will ask you the exact time when we will receive those goods may be that 100 percent accuracy may not be there because still you can predict that may be within that time we will receive the goods but we are never 100 percent sure right same is the case when I am talking about the quality of those goods being transported from point A to location B right so then also because during that transportation or handling in the warehouses may be we might have damaged some of the products if the initially we shifted 1500 units all 1500 units with the you know promised quality are reaching to the end customer that again we are not sure and then some kind of maybe disruption in terms of recently we have seen covid 19 pandemic where the complete supply chain was disrupted because of the shutdown right so then again the availability of the raw material finished goods factories were shut down worker were moved from those location to their villages so that is again a kind of uncertain situation right so how we can deal with these kind of uncertain situation either happening from the

customer side in terms of demand uncertainty or happening from the supplier side in terms of supply uncertainty so whenever we are talking about uncertainty these two points we need to keep in mind because always in supply chain management the primary fight is to meet the demand with your supplies whenever there is uncertainty with the demand or uncertainty with the supply so definitely challenges we are going to face so how the very first solution that comes to our mind is that let us keep some extra safe inventory in our retail outlet right so that any customer visits our showroom can get the inventory right can get the product so this is one way out but yes then how much inventory you will keep but then maybe for tomorrow you are predicting the cyclone and maybe for next 10 days or maybe 10 months there is no cyclone so then what you will do with that extra inventory so that also you know the chances of getting that inventory obsolete is also very important point and then sometimes what is happening you are ah because of that end season sales are there and then you are selling the same inventory at the reduced price so these are some of the challenges when we are talking about the uncertain situations right and in supply chain these uncertain situations can arise either from the supply end or from the customer end in terms of demand let us first talk about the supply chain uncertain Obviously, when we are not sure about the see suppliers are one very prominent stakeholder of any supply chain from where the supply is coming right. So, the very basic purpose of supply chain is to ensure the smooth supply of the raw materials to the production line right. So, that means, when it is unpredictable situation or volatility is there so that means, you cannot predict the situation 100 percent right. So, anything can go wrong with the supplier may be with the one supplier or may be with the multiple suppliers right.

So, then how you will respond during that situation like we coded the example of COVID-19 outbreak right. So, there can be natural disaster, there can be manmade disasters. So, in nutshell we can say these factors demand fluctuations, logistics disruptions, labor shortage, geographical any event is occurring right. So, these are some of the factors which can interrupt your supply chain smooth supply chain right. So, in terms of supply chain manager our responsibility is how we can ensure the smooth supply of the raw material or whatever component we are using to produce that finished good finished product.

So, let us keep we will discuss 4 scenarios supply uncertainty on the row side and demand uncertainty on the column side. one very ideal situation is when we have low supply uncertainty that means you are pretty sure about the supply that you can maintain the smooth supply and then low demand uncertainty that means you are into a market kind where may be you are dealing with those products where you have the continuous supply continuous demand like we counted sugar industry salt industry steel industry

cement industry those kind of goods where you know continuous supply is there so in that case if this is the kind of industry what is the primary focus of any supply chain is to be efficient because there is nothing much you can do with the product in terms of innovation right cement industry will provide all same packet size right and same quality almost same quality and it is very difficult as a lemon may be customer you cannot analyze the quality right so then what you will do with you know in terms of USP your USP lies majorly how efficient you are while you are pricing your product right so pricing is very very important in this situation first scenario second scenario where we have still stable supply but we are not sure about the demand high demand uncertainty right in terms of if you are coming with the new mobile phones right so only thing component are same sometimes you are adding some new features adding some new app software so that way you are innovative in that way right but in that case your supply chain should be very very responsive quickly you should respond to the customer demand that can come from anywhere right so high demand uncertainty from particular market may be demand is coming and for next 10 days there is no demand from the same market and some other location we are getting high demand right so in that case how supply chain can respond very quickly the third scenario this is the second scenario third scenario is where we have high supply uncertainty but demand is still very stable right but supply we are not sure so in that case what we can do like we talk about semiconductors in these days you might have seen that demand for the automobile industry is almost saturated with all the players right they are may be some fluctuations are there but still they can figure out how much is the demand but if you talk about the recent news was there and now Indian government also started establishing semiconductor 2 or 3 location they have identified where they are planning to set up the semiconductor plants right so in that case because the news I was talking about more than 50 lakh units were with the manufacturers Maruti Hyundai Toyota all those manufacturers but they were not able to sell because of the shortage in the chip right so then in that case what you can do risk hedging may be the best option for managing your supply chain where you can pool your resources if same industries may be many players are there they can pool their resources to meet that kind of saturated demand and last fourth case is where your supply is very uncertain your demand is very uncertain this is the biggest challenge when you are not sure about anything right then the agile supply chain will help how flexible you are with your supply chain if demand is suddenly coming from one end how you can meet with the you know minimum consumption of the resources because meeting demand requires supplies right but we are not sure about the supplies as well so then those kind of you know industries we have to be we have to come up with your agile supply chain let's talk about healthcare supply chain. May be the emergency services you are providing with the ambulance may be you are providing the different you know blood groups right and then supply is also uncertain in that case whether you are maintaining those all the blood groups or not and then demand situation

in healthcare supply chain is healthcare supply chain is usually we talk about emergency supply chain disaster relief operations from where how many first thing is we need to locate how many people are affected .Then we need to ensure the minimum supplies with the medicines next minimum supply how they can survive for maybe 8 or 10 days then the rescue operation will happen so we need to supply them the medicines and the bread packets and all that that they can survive right so these are four different scenarios we will discuss when we will discuss about the uncertainty throughout your supply chain right talking about demand uncertainty refers to unpredictability and variability coming from the customer side so sometimes you are keeping that much stock you stocked in 2020 you forgot to use that and still that inventory is with you but at it's not coming with the you know deadline or maybe expiry date so you are using somewhere in 2050 but that inventory is now you are counting that it is consumed but it is still with the customer that can also happen right. if those kind of products are there so but demand variability usually coming from the customer side and why it is happening because of market trend suddenly if there is change in the market trend obviously customer focus will shift to some other alternatives consumer behavior is also very unpredictable sometime you are going maybe you are feeling that next 2-3 months you will be very busy let us stock all the grocery items in the house so that next 2-3 months I will not get the time to visit the retail shop right so that way you are maintaining extra stock but usually you are not buying for more than 8 or 10 days or 15 days inventory so then your behavior in that way can be you know very complex to predict economic conditions so suddenly if there is a recession buying power purchasing power of the customer will reduce so that also we need to take care when during covid only that happened that most of the automobile industry they faced huge crisis in terms of managing the demand because of the very low demand right and then external events are always there which can affect your demand right implied demand uncertainty is different from the demand uncertainty where we are talking about the special thing the special promise we are meeting and we are promising to our customer right where you are providing the emergency services let us talk about say we need ambulance services right I am having one taxi so may be first scenario is I am using it as may be taxi or second is I am using it as ambulance so then using taxi still the uncertainty is there may be for whole day you are not having even single ride and then may be for the next 12 hours you are getting multiple rides so how you will manage as long as you are having only single taxi right how you cannot manage maybe you can hedge with the other hedging supply chain you can go for where you can pool the resources you can get the taxis from your other players in the market and then this is how you can meet the customer demand but let's talk about the second scenario where we are talking about the ambulance where any this uncertainty is at the highest level and because we are promising services during emergency only when we will call ambulance when we don't want to wait even for five minutes but in case of taxi you can wait for one hour right you can wait for half an hour if you are planning for long journey so you can wait you

have called taxi person and then he took 30 minutes extra then you took may be 15 20 minutes extra to board on taxi and all those things right so that in that way it is not that kind of emergency services but implied demand uncertainty when you are promising you are actually referring to that portion of the demand which is you know very very uncertain and kind of emergency services so if talking about that order frequency is also not sure lead time is very less quickly you need to respond fire services right so that people will get the minimum time right to deliver to you know provide the fire services and then services level also expected are you know in terms of services level different varied services level are expected from the customer so this is very important in terms of implied demand uncertainty so ah talking about emergency orders and long lead time so this if long lead time is there we will talk about demand uncertainty if your emergency orders are there we will talk about your this implied demand uncertainty so this is the basic difference because we have very short time to respond to that query to respond to that you know the demand coming from the market market right but in case of the other supply chain where we have long lead time still we can take some time to respond like if you are placing order with the zomato right even they are promising fast delivery but they have 30 45 minutes one hour sometimes right they can delay those services bad weather condition they can reflect and then they can ask the customer to wait for maybe little longer hardly matters but in case of emergency services disaster management supply chain you have to be very quick to provide those emergency services so impact of services level as the services level will increase implied demand uncertainty will replicate in the same way will increase like anything so that also you need to see if you are providing the services through different channels right so again the implied demand certainty will increase because now it's not only you need to cater to the demand coming from one channel if you are selling tickets if your airline industry selling ticket from your through your may be your own website through make my trip through goviver through exego through irctc all those different channels are there so in that way implied demand uncertainty will be higher so let's talk about the supply uncertainty already we introduced little bit about how it can be unpredictable during your when we are interacting with the suppliers right so what can be the factors capability of the supply chain and life cycle position very important when we are talking in terms of supply uncertainty.

let's talk about the capability of the supply chain capability in layman terms capability how capable your supply chain is to you know meet all the demand coming from the customer end whether it is variability is there in the demand whether quality level expected is different from different customers some are looking for superior quality some are look looking for maybe the superior pricing policy some are looking for maybe variety so how your supply chain is capable enough to meet all those you know ah different kind of demands coming from the customer with the so how you can meet that first is your production process second is your yield quality yield so how quickly your

production process will respond to change in the market demand and how quickly you are shifting from model 1 to model 2 let's say now there is high demand for model 2 you will stop model 1 model 3 model 4 and you will suddenly change over to the model 2 because there is more demand coming for that particular model right then quality is how efficiently effectively you are converting the raw material into the finished one right and ensuring the final quality so once you will stabilize in that market standardize your production process your quality will improve automatically but if you are coming initially with you know new product design new process design then in that case it will take little time to standardize that process so that's why we always talk about in production operation management it is very very important to reach that standardization of the production process as early as possible so that the rejection process rejection can be reduced raw material rejection can be reduced in that terms life cycle position of the product see so life cycle everyone knows that this is the life cycle right where we are talking about the introduction stage we are talking about here the growth stage here we are talking about the maturity and then finally our product declines so just quickly i will relate this life cycle position and how it is putting uncertain situations through the supply chain see this introduction stage if I will characterise that means you are very very uncertain not only with demand but as well as your supply right because just now you introduced the new product you are not sure about the demand from which market the demand will come and then because you are still in the process of standardising your raw material components your process design so your supply is also not sure and you are also not sure how many vendors you need to develop whether that particular product will be success or failure so then you cannot suddenly go for multiple vendors right so in that way it is very uncertain so obviously in that case you have to be very responsive in your supply chain why i am saying responsive when you will go somewhere here you should be efficient cost efficient but when you are at the introduction stage you need to be responsive that means if demand is coming from anywhere you need to respond quickly so that means cost will be little higher in terms of we are not sure about the demand in terms of we are not sure about the supplies that maximum inventory we are maintaining standardization is not done of the process so that means cost of production productivity will be low when productivity will be low that means cost of production will be higher so that means the pricing will be little higher so because you need to recover the R&D cost as well so that you need to consider because as soon as you will go into the growth stage other players will come into picture competition will be there in that case you need to lower down the cost you need to lower down the price as well so till this point you need to ensure that you have recovered all the R&D cost including the profit margin as well that also you need to ensure right and once you will go into maturity stage now your processes are standardized .demand is in that way saturated supply is saturated you can forecast you can predict how much customer share is there if you are maintaining somewhere around 15 to 17 percent customer share so you you see fluctuation may be

one to two percent right so that much you are sure about the supply so in that way you can be efficient so when you are going to maturity stage you need to be you need to be more cost efficient and quality also you need to promise implied demand uncertainty already i discussed if there is implied demand uncertainty so that will that effect will be replicated in the supply as well how many ambulances are required may be at the same time then three calls are coming all cases are equally important so to whom you will address the first so that will pose extra you know challenge for this so how we can counter supply chain uncertainty first thing is we need to diversify the suppliers that means multiple suppliers different geographical location already in one session i discussed about single supplier versus multiple supplier . If anything goes wrong in that geographical location any disaster like cloud bursting or flood is coming earthquake is there so that means your supply chain interrupted right so then you need to locate different locations right sometime what is happening you are locating your supply your partner overseas as well when you are going overseas may be overseas is required may be you are getting cheaper product with the lesser cost and then maybe quality is another one maybe technology is another one quality level is high technology is another factor you are buying from overseas player right so but this is long supply chain so but you can't replace all the suppliers with the overseas player what if that overseas supply chain interrupted right so one maybe one or two local vendors i will maintain who can ensure the smooth supply during that time but when I am sure about the supply and demand and that much big lot is required obviously I will go overseas from where I can negotiate the cost quality and technology and performance all those things enhance visibility if you are you know real time data is provided by tracking your inventory why whatever action you are activity you are performing at different stages of that supply chain right then you can in that way reduce the uncertainty Why uncertainty is there in the supply chain? Because we do not have the full information. Either we are dealing with the partial information, vague information. uncertain information right if that can be let's say how we are tracking right now is that this much demand is coming from the customer okay 50 units let us place the order for 55 units right then let us manufacture maybe 60 units let us place the order with the supplier for 70 units so this is how your demand is still 50 but you are placing order for 70 units how we can electronically we can change that so can so that that visibility can be maintained build flexibility so that we need to ensure why storing the inventory and agile manufacturing practices fostering collaboration so this agile manufacturing can only happen if I am asking my supplier quickly supply 5 units he is ready to supply 5 units now I need 50 units he is ready to supply 50 units now change over to second model he is ready to change over to the second model so that you know collaboration with the supplier is required and that is only when you can strengthen the relationship with the stakeholders communication trust and collaboration it's not only the problem with the manufacturer the seller its problem if something uncertain situation is there you need to deal with that uncertain situation throughout the network suppliers,

distributors, your manufacturer, warehouse all those agents need to work in line and then implement risk management practices to manage risk first is you need to assess the risk then scenario planning may be multiple alternatives you will see what are the different scenarios if you will go with route what can happen if you will go with route b c d then what are the different you know alternatives and what will be the different outcomes and then we can find out the chances of happening something right probability theory right we can find out that.

So, that invest in resilience how we need to invest more and more in to develop that robust infrastructure. So, that we can come up with the backup inventory, backup location, backup manufacturing. So, that can be supported. Monitor and adapt we need to monitor the supply chain performance regularly with the changing dynamic that market scenario right and we need to tap the external factors as well which can come and play important role. right already we talked about we can conclude this that improve visibility and communication throughout the supply chain and this will only happen when we are sharing the data information with all the stakeholders right so improved supply chain visibility will lead to agility so quickly you can respond to proactively you can respond to whatever ah uncertainty is coming risk is coming from the market so that you can tap quickly So, just before proceeding further, I will show you one video where you can see how these intelligent supply chains, what are the expectations in terms of when we are talking about the intelligent supply chains.

so here i have included some video links you guys can just quickly go through these videos so you can see the only way to deal with this kind of supply chain uncertainty is transparency and visibility throughout the supply chain so that quickly you can share the information with all the stakeholders and accordingly that quick action can be taken So, just uncertainty versus risk, risk is something that can be estimated, if you are going this way you can be sure that may be there is 15 percent risk, if you are going to this way may be 25 percent risk, if you are going to this way may be 10 percent risk, but if this risk is 25% maybe the returns are maybe 35% if risk is 15% maybe returns are only 20% so that way you can find out so risk of you know adopting a particular action and then you can find uncertainty is something that the probability you cannot find out right. This is clearly uncertain situation which can happen which cannot happen right so and these are some of the events like we talk we are talking about the disaster events right so who can predict that this is going to be the you know depth of that particular disaster still we can predict in that way that cyclone is coming low pressure zone and that all we have environmental you know tracking parameters where we are predicting up to some extent right so but how much it is going to interrupt your supply chain is all together another story right so talking about supply chain uncertainty and risk either we are dealing with the information

uncertainty logistics related customer related or environment related uncertainty and risk so logistics related uncertainty simply means when you are delivering the product from one end to other end so anything can go so that means that will if anything is interrupting your physical flow of the goods within the supply chain so that means that can delay your delivery time transport network management will be into picture storage issues will be there you will not be having enough inventory carrier strength flight transportation operation all will be affected right if you are not having the exact information related to your logistics right or any uncertainty is there with the logistics right and then uncertainty may these uncertainties may impact your efficiency and effectiveness of the overall logistics process you are not sure about how how much you need to warehouse how much you need to a transport how much you need to go for the final delivery so those kind of things you are not sure right so uncertainties are on that side information uncertainty this is a kind of uncertainty because this will lead to all other uncertainty if any lack is there in the information delivery that means your whole network is disturbed right If you are not getting proper demand function, how it is going to behave for the next 15 days? How you will plan your manufacturing cycle? How you will plan your procurement cycle? How much inventory you will store in the storage house? So, that information accuracy, availability and timely processing is very much required. These are some of the features when we are talking about the information uncertainty. customer related uncertainty is always there how many customers are visiting your retail outlet what is the footfall how many are converted may be somewhere you can say may be on an average may be 50% or 60% you are converting but then this is something consumer behavior is very very typical to predict reputation risk if negative you know brand image is associated or some negative experiences are there so then also you need to tap that right or customers is having that reputation right so receivable risk if you are giving something on credit so whether you are going to receive that or not that is also kind of risk then forecasting errors demand delays to customer those all can come from the customer end because sometimes the customer are just roaming around the market and buying nothing sometime they are not coming with the mind that they will buy something and buy so many stuff in the end so that those things are very unpredictable environment uncertainty in terms of all the dimension political, economic, social, technological, environmental, global factors whatever there any global event Russia, Ukraine war suddenly your crude oil prices are going up suddenly transportation industry is hit badly so cost of shipping the product will go like anything or any other product coming from that region will affect adversely anything any global event happens so and then political if there is change over so you can see how the market will react right so those all market sentiments are you know attached with the if there is change in the government right how we can mitigate these supply chain uncertainty some of the measures we can take regular plan generation planning is something is not permanent if you are looking for this is permanent plan that cannot happen so you need to generate frequent plan may be today

whatever I am planning tomorrow it may go obsolete so may be some other factors which we you know yesterday we did not considered and today are very very important right so in that way you need to go with very frequent plans you need to evaluate again the plans with the changing market scenario and then when you are saying that that means that if you know you are still working with the manual kind of planning so it will not work right so automatically you need to you know automate your warehouses inventory your stock your manufacturing so that immediately information can be shared and if that is happening you can reduce the inventory cost by 37 percent because continuously you are coming up with the changing environment you are modeling in your equation right consistency in planning now see if today I am saying I am a responsive supply chain and something goes wrong in the environment and then I am saying that I want to compute on cost how it can happen if Rolex suddenly start advertising that cheaper product watches they are providing who will believe in that and then the first thing will come in our mind those who are bearing the Rolex and then whether they are obviously they will be compromising with the quality that's why they are reducing so that is something that consistency in planning should go throughout the supply chain right so that standardization today you are responsive tomorrow you should be responsive that is the main thread you know connecting all the stakeholders so integration of additional data source it's not only one channel through your marketing channel or distribution or sale you are getting the data how you can track the pattern through different social media websites that is another source how customers are rating those products on different websites those also can be a source of for your you know renovating the product supplying the product to the market so that you need to align your resources with the demand whatever it is coming and accordingly you need to change your production plans as well. Enhanced visibility across the supply chain is again now bullwhip effect.

So, this I was talking about like let us say this is how the information gets amplified over the stages. Here the customer is placing order for 50 products with the retailer. retailer is placing another may be with keeping in mind may be there may be you know increase in the demand. So, he is placing order 75 with the you know manufacturer, manufacturer then again manufacturer is there and then your raw material supplier is there. So, raw materials manufacturer is placing for safer side may be 110 products components.

So, this is see how this information gets amplified over multiple stages, how you can reduce that with may be electronic data interchanges there. So, quickly you can share the exact information. If 50 is there, you need to require the material as per 50. Why to keep that extra more than double inventory? So, that can only happen when you are having holistic view and performance tracking KPIs where you have the not only KPIs for one manufacturer or distributor or warehousing. You should have keep KPIs aligned with all

the stakeholders and one holistic approach system approach should be adopted for this.

So, talking about the last concept related to this is supply chain macro processes. See, whatever we are doing with the supplier known as supplier relationship management, internal supply chain from raw material to finished goods. here raw material is coming whatever we are doing within our manufacturing unit is internal supply chain management and how we are managing with the customer is customer relationship management right so what is happening with the supplier we are sourcing the supplier we are negotiating them on the quantity quality price right and then we are buying that buying also not only single lot will see in one month how many lots will buy what will be the quantity in each lot and then throughout the year how many lots we are going to buy so in that way when you are saying that these are our suppliers you are sharing your recipe with the suppliers only then they will manufacture the components for you right so design collaboration is there and obviously supply is there because you are getting the supply once you will get the supply within your manufacturing unit how you will convert that raw material into finished one you will store your raw material then strategic planning will be there maybe you have three different production lines right One production line A and B model you are running. Second production line C, D, E. And then maybe so many other different models you are running on the third production line.

so strategic planning demand planning will come into picture how many units of D today will manufacture how many units of B today will manufacture so when we will shift from A to B how quickly we will shift that so internal planning how we are going to fulfill the order so all supply order you need to match with the internal supply chain management we discussed about the first three main streams of supply chain here you can say the first stream this is the second stream this is the third stream which is interacting with the final customer now you need to market first you need to identify the demands the expectation from the customer only then you can you know go for designing of the product designing of the process how you will convert raw material into finished one then pricing how much customer is willing to pay is there really that problem is really that important for the customer that he is ready to pay this much then you will sell and once you will sell you will provide after sales services you will installation related services any returns are happening or any damages are happening or may be you are providing the spare parts to maintain the product may be over 20 years so these are some of the things which are related to customer relationship management so these three macro processes within the supply chain we can see and whenever there is any uncertainty among any of this may be we figured that market demand in a wrong way will plan strategic planning will be in wrong way and will source the wrong component. So, we need to align all these macro processes. So, that we can maintain the smooth supply of all these materials already we discussed in detail. So, uncertainty basically coming from these four sources, these four

sources you need to tap and need to maintain the, but still that cannot be 100 percent accurate information, but still you can somewhere you can go for that and how you can mitigate that uncertainty you need to collaborate with the suppliers close relationship you need to enhance the visibility and relationship we have seen that video that throughout that supply chain if visibility is there you can track the operation right and your supply chain should be flexible agile quickly you are responding and for you are responding for anything right you ask me any product i'll provide you any product right and then you need to continuously monitor your kpis your risk and then you need to develop the resilient supply chain if anything goes wrong even then your supply chain is standing there right so that's all these are some of the references so thank you very much