Logistics & Supply Chain Management

Professor Vikas Thakur

Department of Humanities & Social Sciences

Indian Institute of Technology, Kharagpur

Lecture 18 : Trends in Logistics

So hello dear friends welcome back to NPTEL online course on logistics and supply chain management. So today now we have reached towards the end of this logistics chapter where we will now we have explored different functional area under logistics management we have seen the industry scenario, we have talked about the international logistics, we talked specifically about the e-commerce industry. So, now we will talk about what are the future trends, what are the drivers or driving forces factors which are you know forcing us to you know keep on renovating, innovating our logistics distribution network. So, today we will try to conclude this chapter with the latest research directions in the field of logistics management. So, we will try to cover, we will spend a couple of sessions again on this discussing about again just brief intro from where this logistics concept started. If we will talk about the modern logistics, what are the key stakeholders which are coming very prominently in logistics industry.

We will talk about some modern logistics concepts and then we will talk about the factors which are working as driving forces to change our logistics strategies every day. We will talk about the trends in logistics industry. So, overall view and then we will talk about special focus in Indian logistics industry. So, we will talk about definitely challenges what modern logistics now facing.

And in the end we will talk about some performance measures how we are evaluating our modern logistics system right now. And we will end this discussion with the some small cases right we were doing earlier. So, let us start with the history just quick overview. actually after world war second so many of the countries they realized that we they were having even they were having the enough resources but somewhere they lagged with you know how they could use those resources in that optimum way so maybe the result may be different in that way right so they face that this optimal utilization of the resources as well as the coordination among the various stakeholders working in that complete supply chain that could not be achieved somehow and the major part we were lagging there and obviously, the technological integration was not at that level. So, we can understand.

So, these were some of the failures or drawback they investigated specially talking about the military context. so then they started shifting towards the computing capability how we can go for mathematical modeling and we can use different software if you talk about warehouse management how we can use warehouse management software transportation management software inside the warehouse inside the container how we can utilize the maximum capacity, we can track the unutilized capacity and in that way we can design the packaging or we can design the total complete load which we are going to ship in that particular container. So, many algorithms we as a part of operation research like we have algorithm for assignment problem which market should be supplied from which factory, then we have transportation algorithm how we can pick the best route considering the distance, considering the road condition, considering the weather conditions all those things and then we can minimize the transportation cost. We have other methods queuing theory and we have simplex method where we can utilize all those operation research tool to you know go mathematically so that the subjectivity can be removed totally when we are going for decision making and we can be more objective in that way. right so we try to you know grow professionally in that way and then we somewhere we realize that it is not that area that today I am manufacturing something let's start you know distributing the product of our own right so this is area which requires special attention because if you see almost 50 to 60 percent of the cost this your supply chain is contributing if you see 60 to 70 percent cost including your raw material sourcing including your manufacturing including your transportation distribution warehousing order management from the customer doing the doorstep delivery right so this much cost if one functional area is taking obviously it becomes very very important that we need to address this in more professional approach right so now as the local transporters we cannot do that we cannot handle our products or services of our own so let us outsource this to some professional agency which is known as third party logistics services provider.

We talked about first party logistics, second party, third party and the evolution towards the six party logistics services where they are completely taking care of our complete supply chain including the manufacturing, raw material supply, and to the end customer and then they are you know doing the decision making analysis as well based on the information they are collecting from the market so those kind of professional services are required when we are talking about the modern logistics so it is not that anyone can come and can handle those things and when you are saying talking about these stalwarts so obviously UPS, FedEx, Walmart, Flipkart, Amazon, eBay how? delivery how they have changed the overall scenario right so ecart how they have changed the overall scenario so in that way if your competitor is having access to the expertise and you are still going with your traditional way where you are delivering your food packets of your own you are having the restaurant you are delivering the food packets and then your partner is

collaborating with swiggy with zomato with other a courier services right so you can see how much efficiently you can work how much efficiently you can focus on your key area your competency and then how can be you efficient when you are talking about the transportation and distribution services which is totally your unknown area right so over the time when we talk about e-logistics now it has come that development of RFID technology or API technology or we are talking about automated systems right so internet of things so we are talking about so these are some of the platforms which are driving the you know next stage distribution or logistics platform So, here I have included some video links, you guys can just quickly go through these videos and then we will continue our discussion on the topic. so you can just see in that video what I was talking about makes more sense when you say why we are failing with inventory keeping stocks why our products are getting obsolete in the inventory itself why we are damaging the products in the handling when we are talking about warehouse management why we are talking about hundred people are working just searching the products items and then picking the product taking time to package that product and then again shipping. Why cannot we do it automatically where there will be no manpower involved, robots will be handling the products in that way we can be error proof and then we can manage the inventory as well where stock rotation can be ensured. So, that no product goes obsolete in the warehouse only. These are some of the latest trends we have to as a player in any industry we have to move towards that innovation.

So, let us talk about categories of modern day logistics. So, now we are supposed to provide multifaceted approach and we need to handle so many different activities related to the consumption, production and distribution of the goods. within city or outside the city, we cannot say that this our coverage is not in that area. So, when we are talking about your wide coverage network. So, obviously, there will be variation in the city size, there will be variation in the geography, economy, culture, politics.

If any part of the world you are operating political instability is there. if that is very that area is very prone to natural disasters if something means wrong maybe with the economy fluctuations right economy policy something goes wrong and then you need to take care so any disruption is happening in that way so this logistics network these days is going to be very diverse and going to be very complex right so these are the forces which are driving so talking about some of the you know a major area or may be you can say industries which are coming with these or where we need to be you know in that way very efficient is kind of retail right retail either you are going through your fragmented stores or you are going through your one stop solution market so in that way you have to ensure the smooth supply of the product but how you can ensure the smooth supply when your supply chain is having that information what type of items are required how much

how many items are required what is the quality level expected from the customers and what are the delivery patterns in in small lots they are buying or they are buying in big lots right so that that will you know help you to design your next stage logistics network talking about consumer shopping trips this is also now frequently happening that you are visiting you want to go out with your family right and then in the meanwhile you are visiting the grocery store you are visiting the apparel industry or store or you are visiting any other shop right in that one mall you are visiting all those shops right. So, we are designing now in these days in that way so that if the customer is visiting that particular mall he can almost address all the problems or issues related to his demand at one place right. so now when they are moving towards different stores right so obviously they will pick the items so then as that store we are making this promise that you can just pick the stock and then we will deliver you that stock at your doorstep that is also one very prominent model if you talk about the grocery items specially right so obviously this will ensure more again energy consumption right then you can take the courier services as well and either you take dhelivery ecart or ups those kind of global players are there which they are handling those stocks or sometimes doing the cross talking right just to distribute them talking about the industry hotel restaurant catering you you you are aware about zomato you are aware about swiggy right you are even aware about the those exclusive showrooms or outlets which in food industry only where they are delivery they are ensuring the delivery within 30 minutes right if you talk about dominos pizza right McD so those kind of promises either they are collaborating with the local partner or they are having their own distribution at whatever way they are working right but this is a kind of industry emerging like we discussed about the example where we don't have you know customer is not having that much time where every day or other day they can go in the restaurant and sit for two hours and enjoy that meal whatever he wants to take right that time is limited now so now hotels are coming to your doorstep so that is another very emerging area so obviously now we are getting matured in this area but how we can combine more orders to be more efficient in that way and then we can ensure the free delivery home packets these food packets talking about construction if you are talking about construction in some rural area semi urban area still it is easy, but if you are talking about construction within the city. So, all logistic related problems are there where you will store the material this is first point even you can ensure the raw material supply, but the area is not enough to you know store the raw material.

So, in that way so you need some temporary storage centers or some third party who is storing all the raw material related to construction. whenever you will say kind of just in time services we can provide you in the urban area as well avoiding all the traffic and whatever restrictions are there we cannot move this is another area because very close to me i work in this area of waste management circular economy designing the closed loop supply chain So, again waste management is a kind of supply chain which includes your

collection of the waste obviously from households. The next step is your segregation which is very very important to segregate the wet waste from the dry waste to segregate the infectious waste from the non-infectious waste. So, these kind of so many different segregations are there right. depending upon the category.

So, that we can use some waste as fertilizer, we can use some of the waste may be for road metalling purpose, we can may be some of the waste we can again recycle, remanufacture, reuse. So, those kind of things we can ensure only when we are ensuring segregation after the collection of the waste. Then again it is being transported to you know the waste treatment facilities where we will be treating the waste and if not directly to the waste treatment facility may be in between we are having warehouses we are storing the waste temporarily from that warehouse may be some part will go to the treatment facility where we will do the final treatment. some part will go may be for composting purpose to the composting plant, some part may go for may be recycling purpose plastic part, some part may go for road metalling purpose depending upon the how you have done the segregation right so this is complete supply chain waste management so obviously this is again another industry which is coming as very promising because when we are talking about reusing the used products so if you talk about the economics of that so the usually the industries are five times more profitable many reports are there they are 5 times more profitable than getting the fresh raw material and again manufacturing the product. Then talking about industrial and terminal haulage so in cities we have some distribution centers we have hubs where we are temporary storing that products or industrial products even if you are talking about supplies to the industries so that those also we are storing right.

so who are the stakeholders in the modern logistics so obviously first who wants to ship the product and then who wants to you know receive the product those are two prominent players now shippers they are having their own demands and those demands are obviously driving from the customer how customer is you know expecting in that way in terms of lead time, in terms of cycle time, in terms of the quantity he wants, in terms of the frequency, how frequently he is buying, in terms of the delivery options, when he wants the product may be in the evening hours, in the may be 2 to 3 or at what time they want. and what quality they want right and after sales services if any kind of network is there then again you need to ensure the again after sales services how you can provide to your customer right and that also you need to address all these issues at the minimum cost you cannot say that because we are providing you frequent delivery we will be charging you the delivery cost right so obviously as amazon customer flipkart customer your first thing is whenever you are picking product you randomly you check your buying behavior first you are checking whether the free return is available or not whether i can return that

product or not if something is not good with the quality or the fabric i am wearing not comfortable size so many different things can be there right so that is first thing and second thing is how easily i can return that product right and then payment options also so if i'm doing the payment how quickly i'll get that money back in my wallet whether it is amazon wallet or to my personal account right then another stakeholder is carrier who is taking you know your product from the manufacturer to your doorstep now during that this is now the old school of thought when we talk about during that transportation who cares about how we are handling the packets how you are handling my packet I want to see now the level should be like that I want to see where you are dropping my packet where you are picking my packet how you are handling throughout the distribution network so all those things include a basket that is you know in the end coming up with the quality of services you are providing right and then public authorities again very important stakeholders because whatever infrastructure we are using to transport either through ship either through air either through rail either through your road So, that infrastructure has to be ensured by these regulatory authorities only your public authorities and not only this much then to need the there is need to you know check all these operations right if something goes wrong with the customer I have done the payment I am not received the product then you can go to the consumer code and then again how good you are with the packaging how good you are with the sustainability measures right if government regulatory authority they are saying that you have to be you know environmental friendly so what are your initiatives towards that so this this again stakeholder which is playing important role if you see trend in logistics so this is how it is improving and when we are saying from logistics 1.0 to latest concept of logistics 4.0 so then degree of complexity is also increasing day by day but yes degree of complexity is there but then we are not doing it manually we have software we have robots we have automated systems which are automatically generating data processing that information taking the decision on our behalf right So, how this industry is evolving? We were talking about steam engine here and we were locally we were distributing the products. So, sometimes animal force we were using, then we came to electrical power and we started talking about automation of handling system, how we can go for electrical engines and we can make delivery more quickly more efficiently in that way.

then the advent of your computers and IT and change the whole scenario and now we are talking about you know warehouse management software we are talking about transportation management software where we can find out the best route we can minimize the distance we can minimize the cost we can minimize the inventory all those things not manually by using these software right and then now next is the IOT system tagging RFID your cyber physical system in that way we want to connect in the supply chain that anyone can have the transparency can if even we if we are talking about the customer they have the visibility where their product is right now how their product is

flowing how much time it will take whether it is on time it is early everything and as a service provider you also want that information so that you can also make the decision decision will be more informed decisions right so talking about trends in logistics so obviously the basic things those are driving your logistics is automation first sustainability technology right so these all are some of the latest technology we will quickly discuss about these technologies elastic logistics now why we need third party logistics so that if today I need to deliver 10 packets of food I will pay for 10 packets tomorrow there is demand and I want to deliver 100 packets my courier partner will deliver 100 packet it is their headache how they are going to arrange the manpower how they are going to arrange the delivery vehicles but we will pay for 100 So, if that again challenges if you will acquire your own resources. So, how optimally you can use those resources. So, your logistic partner should be elastic enough to give you those tailored solution. Automation we have been talking about using software minimum human intervention. so that inventory why we are keeping you know inventory stocks in books there there can be robots i told you the dhl we discussed just i showed the video of dhl warehouse where automatically those drones are taking the stocks how much inventory is left out where when we need to place the replenishment order right again we need to replenish the inventory so how many items we need to place right which vendor will get the order so all those things through automation we can share blockchain if you are implementing is another a you know parallel digital system how your product is flowing in the supply chain same way blockchain will you know from the first supplier to the end customer will give you complete picture transparent picture how it is and this is error proof system where you know fraud cannot happen this is tempered any anyone cannot interrupt there or it is tempered proof right So, those kind of disruptions cannot happen if you are we are implementing blockchain enabled supply chain.

So, smart contracts if I am saying that let us say very simple example I am getting raw material and from my vendor and it is coming to my show floor before that it is going for incoming quality control check. If it is we will store this in the storage house and then the information will go to the accounts department. that now it is your lot is accepted. So, may be you can raise the credit note to the vendor. So, that means this information should be immediately shared with the vendor that now your information has been.

So, why we cannot go for that as soon as this IQC incoming quality control department is clicking that this lot is ok. automatically your contract should be executed that the payment should be done to the vendor so this is a smart contract right if human intervention is there so many documentation is there obviously it will take time and many stages are there so time consuming right in that way iot will again play a very important role if you talk about how we can share the resources through cloud computing and then

how we can you know place the order automatically our software system will analyze the inventory and will place the orders and will maintain all the activities throughout the your distribution network. So, advance analytics predictive analytics so that we can predict what is going to be the demand not only demand function we can predict we can also predict if there is any disruption that is coming on the way to your distribution network. right so those kind of thing also we can do cloud computing all those software we are not using every day all those solutions technology we are so whenever we need the excess we can go for that right so easily because this is large data we are going to generate right from the customer and from the distribution partner from the shipping agency from the manufacturer from the warehouse partner from the raw material so use data is there but you cannot ignore any part so you need to track that you need to you know process that using your cloud computing using your big data right so in that way logistics robots we have seen that how within warehouse you can use the robots to manage the inventory ai enabled solution combined with internet of things cloud computing and then your ai techniques will take care of all the decision making, when the product should be shipped, when the product should be packed, how much quantity is required, which part of the pin code if you are segregating in that way. So, when you need to place the order for the new raw material, when you need to start the cycle time of that particular model of that product, all those decision you can do that.

AR augmented reality within the warehouse so huge warehouse spread on may be 10 km square area so then if some demand is coming then all human because of you are operating manually. so then then you are searching the product why can't we take the shortest route we just find out the location and our maybe robot or drone will pick the product and will drop the product at your packaging stage and easily you can package and deliver right so these are some of the gps bluetooth technology bifi cellular network or iot enabled tracking solutions you can do you can use right so digital twin is usually we use for replicating the practical scenario in your lab and then you can do all the testing related to how resilient your supply chain is and how quickly you can do that. so here I have included some video links you guys can just quickly go through these videos and then we'll continue our discussion on the topic so whenever you are visiting any these kind of multi-brand stores you might have seen the first very concern that also comes to my mind as well that if we are visiting on weekends so you have to wait first for picking the products maybe for half an hour you will take and then half an hour another you will be in the queue just to process the bill So, this is another very smart solution you have designed those trolleys as that as soon as I am picking dropping the product in that inside the trolley automatically bill is being generated its keep on adding that if anything I am taking out obviously that and whenever I am picking a product it is showing you the your amazon rating as well right so how other customers are talking about that product so usually on e-commerce website this is what you are looking for right so talking about

recent technology in modern logistics is so drones how you can do the last mile delivery using those drones even within the warehouse how you can connect through all your shelves where you are maintaining the inventory your drones robots through wifi and then you are managing those reports and the information is processed that this particular product is required and these many may be 5 item 5 quantity required. So, automatically your drone will go to that shelf will find out and will deliver you the 5 items and then obviously throughout distribution your trucks even if your inventory is traveling through that truck that should also be tracked right so some of the modern logistics concept first is cold chain logistics system this is again very challenging task where we need to maintain the temperature throughout and we are talking about the perishable goods vegetables or milk products or we are talking about the medicines in in case of vaccines because if you are not maintaining that quality so then it may affect the potency of the your vaccines right so throughout that supply chain you need to maintain the proper temperature right so for that we are using special equipment packaging processes so that you can ensure .what are the main components when we are talking about cold chain supply chain temperature control is first thing see temperature control not only within that container if you are shifting your product from one container to other container then you need to ensure the cold corridor if you are unloading the product during that process also you inside the warehouse you are maintaining the temperature what during unloading how you will maintain the temperature.

So, temperature control is very very important in that packaging how you can ensure the insulated packaging. So, that it should be you know prone to your outside temperature variation and that you can maintain the temperature level throughout your journey. monitoring and tracking so how efficiently you can monitor the data related to your temperature conditions and if something goes wrong right if there is any fluctuation your system fails during your transportation your container cold storage system is not working so then how you can you know to those contingency how you will mitigate those risks. So, that because if you are carrying that much inventory. So, if something goes wrong.

So, that is cost then regulatory compliance are there through if you are taking any food related item or you are taking any medicine related items. So, those kind of initiatives whatever the guidelines are you need to follow. second thing is we talked about blockchain how it can improve the efficiency how it can improve the transparency traceability security right because these are tamper proof records and see if you talk about the supply chain this is the complete supply chain when the factory is you know handling over the product to the supplier these much information is generated right loading certificate batch number processing data shipment delivery this information is generated so let's say for recording these four things we are maintaining four different documents we will handle these documents manually to the supplier then supplier again

again will process that material and may be then logistic operator will take care of that then again packing list order number batch number everything information will be generated then again from logistic operator it is going to long haul carrier and then short haul carrier for the distribution house so every stage you see how much information you are generating how even if I am factory here i should have access what the information is at warehouse where the proper monitoring of temperature is not happening and then when the product is reaching to end customer the quality level we are promising we are not able to deliver right so i need to find out where we are lacking so that only i can find out when i am having access to or transparency to complete distribution network so instead of you know providing these documents manually we can how we can do this using blockchain technology so these are temper proof records even someone wants to do that you cannot do that because we are using cryptographic encryption and decentralized consensus mechanism is there right so anyone cannot come and you know alter the information. So, it will enhance your visibility throughout the supply chain and when you are having visibility gain to full information. So, obviously the more inform your information based decisions you can make and find out where the errors are happening where the defects are happening and then in that way you can streamline the whole process smart contract already I talked about whenever the stages are executed right from first to second obviously the payment should be executed in that step only right there should not be any human intervention to again verify the document whether we received the exact quantity why we need to check open every box and then we need to find out ok we packed 20 item in this box there are 20 or not why you are counting manually the weight of the box itself we can find out the average weight should be somewhere in that remit so that means as long as that weight is there quickly we can check the weight and then complete box we can say ok 20 items are there inside the box right and it will help you to reduce cost and delay because smart contracts are there automatically executed so once you will setup the system you need not to you know interfere in that as long as that maintenance is not required so it will keep on performing at the same level so another modern concept is big data analytics and already i talked little bit about that we need to track the patterns trends correlations when customer is visiting during weekends they are coming more right so how i can get the access to the customer related information right all those expectations when when customer is coming to my you know showroom what are the you know expectation in their mind then what are the information or expectation if you talk about all other stakeholders your warehousing partner transportation partner what performance matrices they are generating right where they are right now how we can improve that what are the best practices this huge data we are generating within supply chain then we need to find out the outside world as well right so if you are operating in some obviously you are not operating in isolation other competitors are also working how they are renovating their supply chain you need to get that data right how your other players are you know providing the enhanced services value adding services

then how disruptions can come throughout the supply chain so that whole data related to all these you know events happenings you need to track and then you can take the decision based on that very small example of warehouse management even the container.

So, how you are designing the packaging? If this is the packaging size, this is the product we talked about, this much product you are keeping, these many products you are. So, you see this space inside that cartoon we are not using. So, that how we can quickly have the access through our robot system tracking system we can find out where we are not utilizing the capacity. So, that we can ensure and demand forecasting already big data analytics we can track the patterns of the customers their behavior and then we can find out what is the demand function. and through big data analytics we will have more supply chain visibility we will have more collaboration because that information is being shared with all the stakeholders in that supply chain right so all are informed obviously they will take less time to react to anything if i'm ordering something immediately i'll get the supply because immediately information is being So, risk management will be in proper way because now we are aware about when the disruption can happen still we cannot be 100 percent accurate with the forecasting, but still we can prepare that may be there is going to be heavy rain for next 3 days how we can mitigate with that kind of challenge.

So, those things your big data will help you to you know mitigate. So, we will continue this discussion in the next session. So, these are the references you can refer for detailed study. Some of the reports I have included. So, that is all from this session. Thank you very much.