Logistics & Supply Chain Management

Professor Vikas Thakur

Department of Humanities & Social Sciences

Indian Institute of Technology, Kharagpur

Lecture 14 : Green Logistics

hello dear friends, welcome back to NPTEL online course on Logistics and Supply Chain Management. So, in the last course we discussed about reverse logistics and what are various aspects of reverse logistics, why it is important right and we identified some key performance indicators as per the reverse logistics is concerned. Now, we will start our discussion on green logistics. See reverse logistics is different field and green logistics is sometime what we are we are confusing reverse logistics, closed loop supply chain, green logistics and sustainability. So, these are targeting on different dimensions. Just for just quick review reverse logistics will take care the efficiency effectiveness while moving the products from the end from the point of consumption to again maybe to the manufacturing unit or refurbishment center or maybe to the raw material suppliers.

and if you are talking about green logistics will take care of the environmental aspect in that whatever we are doing our efficiency performance effectiveness will be evaluated with respect to how much we are depleting the environment how we how much we are supporting the environment. So, indicators will be obviously, looking towards how much carbon footprint we are leaving behind whenever we are doing any activity either we are manufacturing the product or we are delivering the product or we are transporting the product related to that. Sustainability is the next version may be where we will talk about not only environment will include the economic dimension as well will include the social dimension as well. So, when we will discuss your complete logistics and then supply chain may be towards somewhere in the end we will talk about the sustainable supply chain management right.

In this session we will try to address these some of the key aspects, we will try to define what is green logistics and difference between supply chain, green supply chain and green logistics right. And then we will see the contribution of green logistics towards the overall sustainable supply chain, we will see what are the key challenges for implementing green logistics, what are the key technologies which can be used to enhance your environmental performance and when we are talking about the performance what are those indicators which will help you to identify not only your performance but also will help you to you know set the benchmark in that particular industry how much

you are effective and your competitors or other players are effective in that industry Then we will go through quick 2 or 3 cases and we will talk about the future perspective also because this is a kind of evolving field where lot of research is going on how we can be more sustainable and how we can be more environment environmental conscious right. So, environmental management is the broader picture in that and while managing the environment we have to be efficient as well right. as you can see from the picture ah when we are talking about green supply chain management so the relationship of natural environment and supply chain operation we need to explore right we need to find out where what are various internal external factors which will affect your performance and when we talk about green supply chain starting with your suppliers from wherever you fuel you are using you are warehousing that you are transporting that to some manufacturer and then may be you are finally shipping the product to the end consumer, how you are shipping to the end consumer by electrical cycles or cycles or may be electrical operator vehicle you are using, using drone you are doing the door step delivery. So, kind of these things right.

So, during that whole distribution network how we can minimize the carbon footprint is a major focus of this particular session on green logistics. So, talking about green supply chain all the function if we will say. So, first thing is we need to focus on green raw material this is the first step. Let us say again if we are talking about that your electrical vehicles will reduce the pollution right, but then you need to take care of from where that raw material is coming the electrical supply if electrical supply is coming from a by burning coal. So, then it is equally affecting the environment right.

So, then you need to find out the sources of that energy from where that energy is coming either coming from a renewable resources which have the minimum impact right. So, that means the first very stakeholder of this green supply chain will be your raw material suppliers. Then when in your manufacturing unit, in your R&D unit, when you are designing the product, you should design product in such a way that it should have minimum impact. Designing means you should ensure that easily you can repair that or maybe you can implement the concept of 3 Rs. you can reduce that, how you can easily recycle that, how you can ensure the remanufacturing of that product.

That will help you, your green design will help you to address these three Rs. Then green purchasing, as I told you at this point, if your raw material suppliers are also focusing on, providing you the green supplies right. The whatever fuel if you are using one very basic example is fuel how you can use the alternative fuels where you can minimize the carbon footprint. We will see if you will use electricity how much carbon you will be generating and then if you are using petrol, diesel. So, how you can calculate that carbon footprint

and then you can obviously evaluate the alternative fuel options and we will go for then the green production.

how you are converting your raw material into finished one that is production, raw material you are converting into finished one. So, when you are doing this transformation process how you are taking care of your you know manufacturing facility within that how you are using the renewable resources of energy and again in manufacturing. it's not only if you are you know eliminating the wastage in the manufacturing unit even then you can you know add something into efficiency you will minimize the uses of components and then you can increase the life of the product if it is quality product you are ensuring quality in the production So, then also you are ultimately adding to the green supply chain management practices. If you are producing more defects when you are producing that product that is also question because you are using more resources than actually required for manufacturing that product. Then green warehousing in the warehousing how you are using automation kind of thing, how you can use the solar energy to supply power to your warehouse.

So, within that warehouse whatever operation material handling you are doing how you can use that in more efficient way so that. So, at this point of time we can understand anything if you are doing is a kind of wastage right. So, that is your big challenge for green supply chain or green distribution. then green distribution how we can ensure the end distribution using may be electrical vehicles means using may be cycles using may be drones. So, those all those things you can ensure right and in the end how much share is by road your transportation by ship by air by train and then you know that when you are doing this.

So, how much carbon footprint you are leaving behind. So, usually if we will say environment conscious we are. So, may be using ship we can be more efficient and if you are using drones. So, then also you can be more efficient in that way when you are you know doing all those logistics or distribution activities. So, quickly green transportation will see high emission of CO 2 gases and because earlier we were not so, much concerned about this.

Then debate started and we have seen that this is increased to 71 percent in 2016 and still it is increasing and we are saying that it will be 50 percent more than and then we are talking about climate change so many debates are going on on that right and then we are finding that transportation is the big reason why this greenhouse gases emissions or maybe climate change is happening and then you have seen in Delhi because usually

during winters it is happening you cannot breathe even easily right so situation is so worst so then the Delhi government is sometime coming with Odd even formula when you are how you can use your you know transportation vehicles so in that way you can limit so many other restrictions are also there you cannot use some type of diesel engines vs4 or those kind of technologies are you know limited if you are using in those trucks if your truck is more than 15 years old even then you cannot enter in that area right so these all things started we started discussion on that we started implementing on that and transportation is because the I told about this 60 percent is approximately the share in when we are delivering the products by road. So, that is a huge source of pollution and these carbon footprint right. green procurement and logistics, how we can ensure purchasing of products and services, those are harmful, those are less harmful. If we are using harmful products as raw material, then if you are talking about green design in the product, even then that is equally harmful. So, it should start from your procurement of your raw material.

so that you need to ensure at the with your suppliers. So, you need to tie up with your suppliers if you want to implement throughout your supply chain. Then green warehouse How if see in the warehouse if you are keeping more inventory that is also kind of wastage. Let us say take very small example in your house you are maintaining sometime perishable items in your refrigerator. So, if you are maintaining 10 items in your refrigerator or 20 items.

So, obviously, refrigerator energy consumption will be double. or not exactly double then will be higher right so that means if you are talking about cold storage always you are keeping much higher inventory so inventory why inventory you are keeping because you are not sure about the demand so why you are not sure about the demand because you did not do that predictive analytics you did not forecast properly you are not aware about the customer buying pattern behavior and that is why you are keeping the inventory. So, that you can meet unexpected demand, but this meeting this unexpected demand then you are then you are not green distributor, you are not green supply chain, you are not doing that right. So, that we need to and even if you are doing stocking extra inventory. So, then you can damage that inventory not only damage sometime in the warehouse only it will be outdated so that means that is wastage so that again wastage is adding to your carbon footprint.

So, then green design your product design should be eco friendly and how you can ensure that at the end of even when you are manufacturing the byproducts you are producing during that should be minimum. right this will happen when you are ensuring in the green manufacturing as well as in the green design. So, when I am converting my

raw material into finished one how much byproducts we are producing right those are going in the environment. So, that is big challenge right and if you talk about the design of the product how we can design such product which can be easily repaired. we can extend the life of the product by just replacing small components right and So, even if it is we can use alternate source if you are using let us say in AC also now ACs are coming with inverter technology.

So, simple meaning is inverter technology means more energy efficient instead of copper winding you are using aluminum winding you are using copper winding and all that. So, just you need to change the raw materials and then you will be more efficient in that way. This you can ensure during green manufacturing, green marketing. So, this you have to ensure during your campaign. So, how whatever expectations or preferences you are recording from the customer and while you are meeting those preferences and expectations you should be environment friendly right.

So, you need to design your product to meet those customer requirements in that way. So, the definition of green logistics should be more eco-friendly and refer to the practice of managing the flow of goods and resources in a manner that minimizes the environmental impact. So, till now we discussed that it is not only that you can minimize by you know using alternate fuel right. The fuel you will use which is you know producing less carbon footprint or less CO 2 emissions right, but we have seen that If you are doing something right at the very first time so that means, that is also you are avoiding producing the extra waste right and even if you are producing quality products then your life of the product will be extended and then that minimum services are required and change over is required or replacing the component is required. So, all those activities are adding extra pressure burden on using extra resources and in terms of that.

challenging your these green logistics steps. So, when we are talking about green logistics obviously, basically we discussed about logistics 3 major function under transportation, under warehousing, under distribution right. under transportation which mode of transportation you should use that is more sustainable like ship using drone right and then warehousing how you can design a green warehouse where you can ensure the minimum inventory where you can ensure the minimum handling minimum rejection minimum obsolete of the lots and then out expiry of the lot. And, then how you are using the what type of resources you are using to supply the energy to your warehouse. And, during distribution when you are ensuring the last mile delivery how you can be more efficient by planning your routes.

And, then may be the last mile delivery you can do by using electrical vehicles or may be your using cycles right. So, green logistics encompasses various activities, alternative fuels already talked about, optimizing transportation routes this also I if you are somehow if you can shorten your route may be by 10 kilometers. So, that much you know energy you can save. so energy efficient vehicles how you can ensure if it is very old will consume more fuel right reduce packaging this we have seen many times inside a small item they are put in two three one plastic packaging is there then one main cartoon packaging is there then outer cartoon packaging is there when and then in the end Amazon is packaging in its own packet or may be flipkart or myntra whosoever is your that e-commerce player. So, they are also putting their labeling kind of thing in terms of packet.

So, that is increasing the weight, increasing the size and again consuming more resources from consumption to deliver it to the consumption point. So, that also we need to take care. so this you can see why we are now moving towards this because we are talking about climate change we are now forced by the governments and government are realizing that now this is forcefully they have done that even odd would you have to do that right you have to follow that They are campaigning about pulling your vehicle. So, that instead of travelling one person in one car may be four can travel in one car. So, this is how we can share the resources.

So, because already we realize that this is the time that we need to be more conscious about the environment. So, these all steps we have to take. So, here I have included some video links you guys can just quickly go through these videos. Show you how this green transportation will help you to reduce the carbon footprint. And then we will continue our discussion on the topic.

So, you can see in this video that how you know if you are saving the space within the vehicle even then you can be more efficient instead of carrying may be if the vehicle carrying capacity is 10 ton and you are carrying only somewhere around 6 ton or 7 ton. So, that 3 ton capacity is unutilized even in the packaging the product size is like this. pack when you will do the packaging you will put one box for this so that is also carrying extra space extra size and and obviously the packaging cost is also there right so in that way this is one only one particular area i have highlighted through this video you have seen that how we can minimize you know the space and then the vehicle can be utilized fully if same will implement in the warehouse same we will implement in the distribution network so then if packaging you have designed intelligently which is taking the minimum space so throughout that supply chain distribution network it will affect your

performance right so quickly we will go through we will try to differentiate although your green logistics is very much part of green supply chain but for the timing because we are discussing green logistics we will see how it is different from the green supply chain as we know green supply chain the entire process from your raw material suppliers to the end customer including your manufacturers including your all the retail distribution chain and all those players are there right so when you are talking about green supply chain So, you need to include all those stakeholders, we need to make them more efficient, we need to ensure the minimum wastage, we need to ensure the energy points, we should use those energy sources which are renewable in nature. And if you are talking about green logistics, obviously we will talk about transportation, distribution, warehousing, how we can ensure the green logistics during that. So, focus will be complete starting with your designing of the product designing of the manufacturing process designing of the raw material what type of you know in particular component what type of raw material you should use you should use steel iron alloy anything which is reducing your cost right again you can take the example of ac like i told you aluminum winding or copper winding and then you are saying that this is inverter ac and then it is 3 star 5 star so that means 5 star is more energy efficient So, that way will help you to reduce the carbon footprint.

So, here our focus will be reducing the carbon footprints, energy consumptions and environmental impact during your three things in logistics, transportation, distribution, warehousing. So, activities are sustainable sourcing, energy efficient manufacturing, waste reduction, recycling initiatives and environment friendly packaging. So, this is complete green solution for your broader perspective of supply chain, but in case of green logistics the activities will be routes to minimize fuel consumption. So, if you can take some alternate route or through your you know vehicle routing system or there are transportation management system softwares which will ensure the minimum distance you should travel and considering the road condition, considering the traffic like how GPS is very simple example how giving different options to you, but then again the sometimes situation can be different. Let us say if you are having more than 500 dustbins in any city and you have to collect the waste.

So, then how you should design the route in such a way every day you are not touching all those 500 dustbins right. So, may be in some highly populated or may be in the city or where shops are there or may be industry waste is coming more. there you are may be travelling frequently may be twice in a day or thrice in a day. So, then you need to ensure first wherever you are visiting your dustbin should be near to full right even if you are picking half full dustbin. So, that means that efficiency is gone you have taken all the way to you know take that dustbin and then it is not completely filled.

So, then you need to ensure that how frequently you need to this is under routing. then you need to ensure that today I am going to pick these 150 dustbins so what should be the route so that I can minimize the distance in that way and I can address all the points so that is one thing and during when you will ensure minimum distance you are covering maximum location you are addressing low emission because you are using less fuel and then you need to think about alternative fuels what can be those alternative fuels efficient warehouse management even if you are fully utilizing the capacity of your warehouse even then you are green in that way. So, sustainable packaging, recyclable packaging we will see one or two cases I have included in the end. So, how they are ensuring this sustainable packaging. Objective is to minimize the environmental impact throughout your supply chain, but here we need to reduce the greenhouse gas emission, energy usage and resource consumption in your three areas majorly transportation, distribution, warehousing because we are discussing green logistics.

So, you can see this is complete cycle of supply chain, you are getting the raw material supply, you are doing production, you are doing transportation, distribution, final consumption is happening. how after the use you can again go for recycling so we discussed in the last session about the reverse supply chain so here you can see if you want to develop your supply chain as green supply chain or your distribution network as green distribution network. So, recycling is important right. So, these all are related items one is helping other, but we cannot replace completely with the reverse logistics is different as I discussed then your green logistics is different and then your sustainable logistics is different. So, green logistics focusing on your transportation and distribution activities in a more sustainable and ecofriendly way.

So, what are the key challenges for implementing this because raw material cost is increasing day by day and then you are pushing your suppliers that now you have to be ensure you have to ensure that your raw material is greener. So, how you can overnight can change the raw material whatever you are using the grade or grading whatever you are using right so that is one big challenge because it's not if you are taking the initiative that should be within your manufacturing unit so we discussed that this is complete chain and every stakeholder is equally important for addressing all these points you need to ensure the profit people surrounding you and then planet as well right so then covid-19 because again in terms of sourcing raw material was big challenge during those times because the shutdown was there and then again manpower shortage was there so during that time the prices were hiked so the reasons were obvious because the manufacturing units were also facing problem in meeting all those demand right after just the recovery of that period so that is one another challenge and these kind of disruptions are happening everyday right so again the big challenge is how we can transform the existing system

into now we are saying the green management system right so because we took decade to stabilize to standardize the process and now we are because government is forcing us or may be our customers are having those expectations so how all of sudden we can go for that right and how we can make that our big system as complete obsolete because now we are moving towards green kind of network right so that is again big challenge and if you talk about technological advancements so simply you need to upgrade your technology let's say very simple example I told you about whether your dustbin is full or not only then you will go to that location and will pick that dustbin how you can ensure that in your office that today that dustbin is filled if we have some sensors employed there we can easily find out what is the level of dust wind right or how we can go for optimization of the route if we have those softwares we can easily find out what is the optimization route how we can ensure this you you need to combine operation research concepts where we can go for optimization right we find the solutions we will go for you know iterative approach and we will find the best optimal solution which will ensure the minimum uses of the resources right so that way you can be more greener and it is not one day thing obviously it will take time. green transport technologies green vehicle routing already we talked about and if we will ensure that you will reduce greenhouse gas emission air pollution noise and space space also in the video we have seen that how you can utilize the space instead of transporting 10 items now you can transport somewhere may be 14 16 items right logistic solution for carbon neutrality so how you can ensure that the last mile delivery i talked about by using electrical vehicles or maybe using cycles how you can ensure minimum carbon footprint by green packaging green warehousing and even if it is recyclable how you can ensure that your customer is aware enough or you have motivated your customer enough that he is ready to deposit all the packaging related material back to your supply chain or distribution network right. Horizontal collaboration is important regarding to pooling of resources. If let us say Swiggy is coming with the I told you the very USP of Swiggy is that even one piece of sweet they are transporting right.

So, how they can on the way they have that much efficient system then if swiggy person is transporting the goods from point A to point B and covering may be 15 kilometers in between how it is it can be efficient that on the way can combine the orders from Zomato from combine the order from Domino's or may be combine the orders from other place right. So, horizontal collaboration will also work in the in that way delivery cost can be minimized instead of having individual delivery network if we can pool the resources then it will be more efficient. So, implementing green logistics we talked about green logistics solution, green procurement, packaging and transportation warehousing we discussed about impact of logistics agglomeration this will help you to you know consolidate your shipments and then you can use the economies of scale and if instead of carrying only 8 ton you can utilize the maximum capacity of the vehicle which is 10 ton

even if you are falling short with your inventory you can combine the inventory from others carbon management practices you need to first to manage the carbon you need to record that and reporting is required right so what are the activities you are doing how much carbon emission is there so then if you are recording this properly then you can go for decarbonization by step by step ok this much carbon 40 percent is coming from this particular area let us say if coming from road transportation right or may be 30 percent is coming from packaging So, how I can address these two issues in a best possible way that so that I can address 70 percent of carbon footprint and may be because obviously we cannot go up to 0, but if even if I can maintain somewhere 30 to 35 percent let us go for that right it is step by step. So, road freight transportation how we can go for alternative fuels and because this we talked about because road we are carrying the maximum share.

So these are all aspects related to this. So let us now quickly explore what are the key performance indicators when we are talking about green logistics. And we have some different councils working for that. ISO standard 14000 series specially related to your environmental related practices and some United Nations has also developed some standards related to how you need to take care of your logistics in more greener way right. So, first is performance assessment in reverse supply chain. so first we need to ensure that reverse supply chain should be minimum means rejection coming from the customer should be minimum or returns coming from the customer should be minimum in the last session we discussed how we can minimize those returns we can come with some promotional offers right first point is we need to minimize that even if it is coming we need to ensure recycling refurbishment or disposal disposal should be your last option because this is directly directly you know contributing towards carbon footprint this should be your last option.

So, recycling and refurbishment how we can ensure. So, first key performance indicator you can see percentage of return products that are successfully recycled. So, you need to record that if even today only 30 percent you are doing let us make it 50 percent first let us go for 70 percent. So, that means, even if you are improving 10 percent. So, that amount use right and you can reduce the carbon footprint. time taken to process the return products because also you need to by you know managing one aspect you cannot just you know go with the hiking the other one so if you are ensuring the recycling but time you are taking so much time taking so much that means resources you are consuming extra so how much cost per unit if you are again recycling what is the cost it should it cannot be comparable to the new product right somewhere it should be lesser than that and because it is going to the secondary market or may be after repair you will find you will reduce the price so then you have to take care about that circle is common transition how we can make our distribution network as circular distribution so that if anything enters or resources enters into that circle should not leave the circle it should revolve in the circle

only if not in the same circle may be after the end can be used that as raw material in some other secondary market.

So, we discussed in the last session about this as well. So, you can see percentage of raw materials sourced from recycled or renewable sources will help you to ensure the circular economy. and then how much waste you are generating if you can waste means something is coming out of this network as waste that is byproduct that is harmful we need to minimize this waste and then while doing all these things you need to check the returns as well whether it is efficient or not so you need to track environmental performance with financial performance is important because these two will lead to sustainability and if you will add the social dimension as well into that so this these three are the dimensions of sustainability so correlation coefficient between environmental performance either you are reducing carbon footprint energy consumption but you need to be financially strong with your stakeholders so profit is reducing by implementing those or maybe initial investment is high but over the time period maybe you can recover that so return on investment you need to record cost benefit analysis also you need to do if you are going for environmental friendly practices. So, whether you are raising your cost that is one concern fuel efficiency if you are reducing the distance covered obviously, you will be consuming less fuel you will be more efficient. So, that also will increase the financial performance as well.

And route optimization again will increase the financial. So, most of the green logistics things steps we are taking that they are adding to the even your economic sustainability as well. Sustainability practices and waste management, how we are recycling and we are ensuring the conservation of the resources. percentage reduction in the waste per unit of output how much we are by product generating we and then recycling rate what is the recycling rate that means we have ensured the green design of the product if you are somewhere you are recycling 80 percent to 90 percent more than that is obviously blessing for that industry right energy efficiency ratio how much energy you are consuming and what is the output after consuming that energy Overall transportation that vehicle how much you are utilizing I told you if your vehicle is carrying only this much capacity this is unutilized.

So, that is also challenge. So, how you can ensure that by pooling with your maybe your competitors or maybe some other players right if not competitors. So, like I mentioned EN and ISO they have some standard setup for measuring the carbon footprint and energy consumption. So, you can calculate the greenhouse gas. and you can compare that emission of your industry with the benchmark or with other industry. So, global logistic emission control council framework is there which is helping us to provide the measures

to calculate emissions and those emissions when you will calculate you can set the logistic performance in that way your benchmark and then you can help in reducing those carbon emissions.

So, this is important how we can calculate the carbon footprint. So, sum of emission from transportation, from warehousing, from logistic activity this is total carbon footprint. So, emission factor we are multiplying emission factor with this total whatever material we are using. So, here is one example if you are using electricity whatever value this is electricity you are using. So, for per unit you will be applying your emission factor 0.

85 for your if you are using petrol 2.296, 2.653. So, you can see the emission factor is highest when we are talking about So, that is why using diesel engines we always focus on how we can go for the alternative fuel. So, in that way electrical vehicles are more efficient because the emission factor is minimum. So, this is there is one software life cycle assessment software that also helps you to calculate you know the how much energy you are consuming. how much environment you are depleting and what is the cost so this software will help you to at each stage if you are manufacturing one bottle water bottle from raw material to end consumption and then if you are recycling or throwing it in the environment it will help you this life cycle assessment software will help you to calculate that harmonization of emission calculation so you need to harmonize because different industries different standards different calculation procedures different units will be there so how you can standardize this and you can compare the emission data so that we can compare all the industry performance with compare with one player with other player and then we can easily we can share the data right only if we are sharing the data only then we can be more you know in that way transparent with the customer then customer will be having the option from where the customer will pick so that he can decide right so this is the case study of dhl where they have initiated the sustainability practices in 2009 and one campaign is go green campaign program where they focus to develop green and sustainability in their transportation services and they claim they have reduced this emission of CO2 gases and you can see the carbon emission is reduced by 50% and pollution emission is reduced by 70% which is huge amount right so because they initiated this campaign you can go through this complete case and how they implemented you can go through right and they also initiated clean delivery and pick up services and for ensuring that they used electrical vehicles or bicycles and they also trained their suppliers who are main stakeholders are providing the raw material and then they also included the main stakeholders customers just under go green campaign so that they ensure the complete collection of the waste. This is personally I felt very strong example and I liked this move by Myntra where they have gone for plastic free.

so earlier they were using these kind of packet now they are using this and this is 100 percent recyclable so this is paper bag and even the bubble wrap which is made of plastic earlier they were using now they are using instead of bubble wrap they are using the secondary used cartoon boxes shredded material so they are putting inside so that the safe delivery of those fragile item can be ensured even instead of using that plastic tape cello tape kind of thing now they are using the paper tape which is you know very beautiful move and then for putting that invoice they were earlier using that small polythene bag now they are using the craft paper pouch for doing the same thing. and then they are using RFID tag and then this is 100 percent recyclable although I could not see the initiatives to collect these bags again and recycle but yes even then this because this is paper and still polluting less environment but yes when you are talking about paper you should know go that much for de-forestration so that also they will ensure that how we can ensure that deforestation should not happen right so they collaborated with so many organization like this is Canopy so kind of non-profit organization who is taking care of all these you know packaging and recycling the materials right And Myntra has also collaborated with the cotton industry to make cotton farming sustainable and so that they can use that cotton for you know using instead of bubble wrap which is made of plastic they can use cotton. And their warehouses are also solar powered enabled. So now they are moving towards that right. So all the fulfillment centers are not like that but they are moving towards that.

So this is very beautiful case of Myntra. So you can complete case you can go through with that case. so the future perspective what can be the future perspective like myantra started this thing now they need to ensure that how they can advance their vehicle technologies for minimizing the emissions routing should be proper how they can use the data element analysis to compare their performance with the best industry performance because still they are not recollecting those packets paper packets right how they can go for that in the minimum cost right and then So, the scale of access to public transport and quality of roads obviously that infrastructure parameters will improve. So, the transportation time will be minimum and whatever fuel we are spending on the road that we can minimize, total distance we can in that way using routing map we can minimize. Battery operated vehicles obviously the best option, but how much distance we can use of battery operated vehicles, right? That is also one question. So, then intermodal kind of network you need to use, sometimes you have to use the diesel or petrol engine, sometimes if infrastructure allows you can go by ship you can go by cycles electrical cycles so those kind of things you can use right this can be means these are future research areas how we can diesel or petrol we can use the now we are talking about methane and some other ingredients you will add into that so that the efficiency can be improved and then we talked about now 4 wheelers are coming with the hybrid engines

where the kinetic energy they are storing and charging their batteries and the performance mileage has increased significantly.

So, again you need to tap with the suppliers, you need to tap with the customers, you need to train them. to ensure the complete collection and in that way you can you know ensure your green and sustainable logistics activities throughout your distribution, throughout your warehousing, throughout your transportation system. So, that is all for green logistics. In the next session we will discuss about the lean practices, how we can reduce the waste of that and we can ensure the minimum carbon footprint. So, these are some of the references you can go for these references.

So, content has been prepared some pictures have been taken from these references. So, that is all. Thank you very much.