Business and Sustainable Development
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Lecture - 24
Green Supply Chain

Hello, welcome to week 4 of this course and in this week we will move beyond the firm's boundary. We will try to see how sustainability can be achieve through the supply chain across the supply chain; we will see what are the policies regulation associated with sustainability.

Also we will see what are the new start up sustainability start up and also the new financing instrument those have been come to the market that how it works; also we will see little bit about the market which is created because of this sustainability agenda and finally, we will do a synthesis of whatever different issues agenda we have discussed across all this module.

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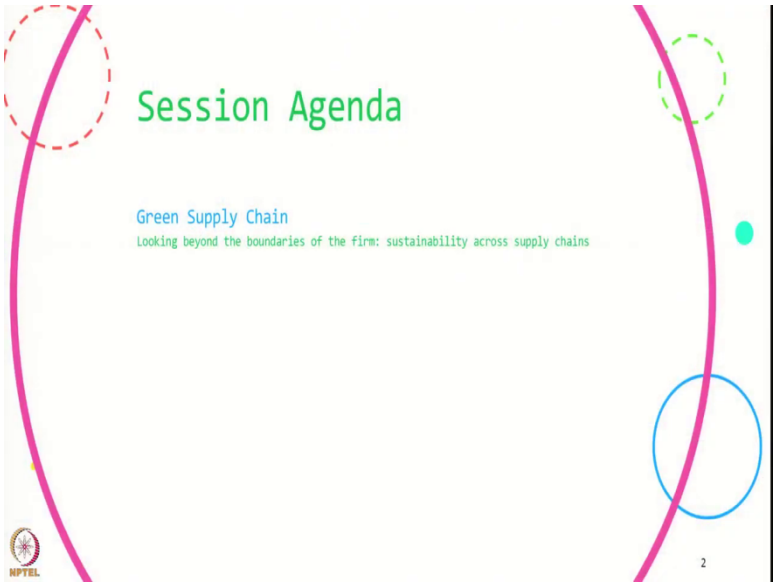

So, to start with in this session we will see what is Green Supply Chain, we will look beyond the boundary of the firm that is sustainability across the supply chain.

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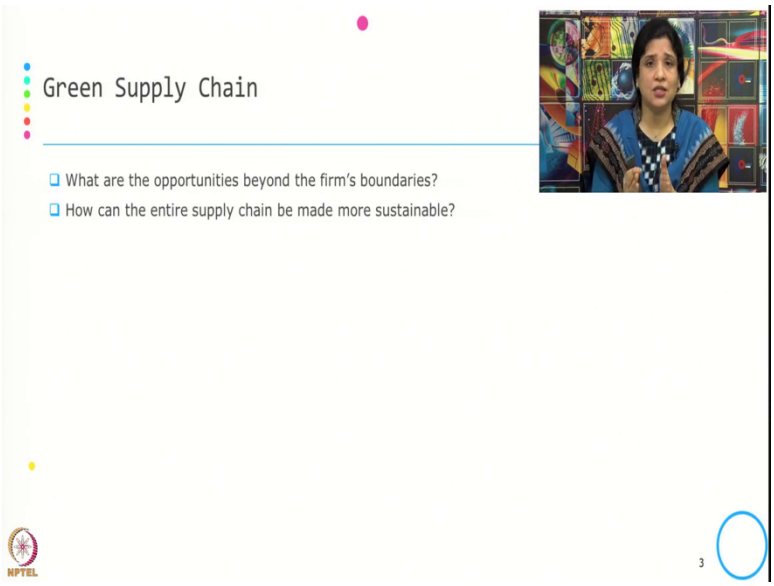

Mostly we will try to address two questions in this session. One, what are the opportunity beyond the firms boundary and how can the entire supply chain be made more sustainability. So, we will see what are the opportunity beyond the firms boundary. When I say opportunity it is about where we can bring the sustainability agenda or where we can make the sustainable beyond the firm's boundary in the product supply chain.

And, also we will see how the entire supply chain starting from sourcing of the raw material till the end product how it can be made more sustainable.

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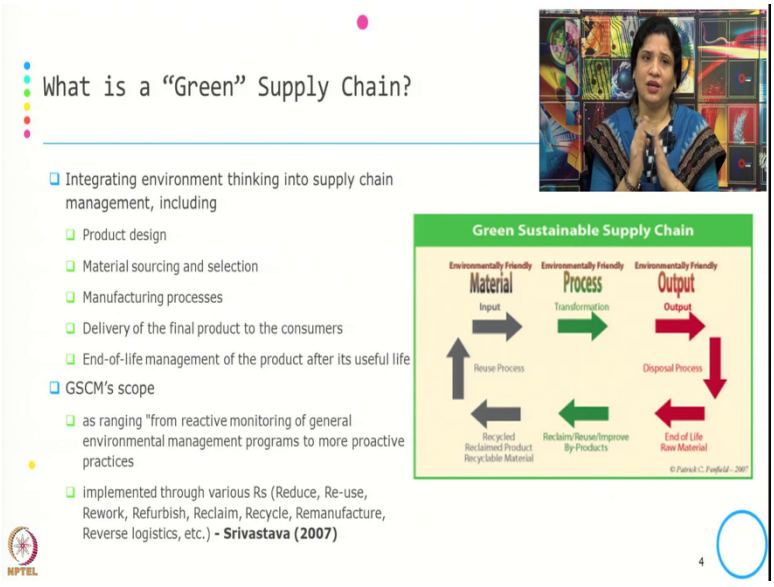

So, now let us understand what is a green supply chain. So, green supply chain is integrating environmental thinking into the supply chain management include including the product design, material sourcing and selection, manufacturing process, delivery of final product to the consumer and end of life management to of the product after its useful life.

Now, Srivastava in 2007 in his paper he has identified what may be the scope for this green supply chain management green supply chain management. This ranges from reactive monitoring of general environmental management program to more proactive practices.

So, this if you remember this also were we discussed when we were talking about the cleaner production process rather than reactive how when we become proactive it becomes more sustainable and it improves the environmental performance of the process.

And, all these proactive practices this can be implemented through various Rs. R stands for reduce, R stands for reuse, R stand for rework, refurbish, reclaim, recycle, remanufacture and reverse logistic. So, the through the various R whatever the proactive practices that can be managed. So, now, if you look at the picture given in the right hand side of this, this talks about part of this Re and also part of this changes what is happening at each stage of the product.

So, typically here the supply chain consist of three stages – material, process and output. So, what we do? When we select the inputs we have to use the environmental friendly material we have to do the process start transformation which is more environmental friendly and finally, output what we are getting that has to be also environmental friendly.

The journey of sustainability does not stop over here when you produce the output. It goes beyond that that is disposal process, what kind of end of life material we are getting from the product after we consume, then those can be reclaimed, those can be reused, those can be improved and creating the by product. And finally, what cannot be used to produce something else that can be recycled, reclaim product and that is recycled material which again get into the material flow in the reuse processes.

So, mostly green supply chain when we are bringing the environmental thinking into all the process or all the stages of this supply chain of a product starting from the sourcing of input to the final product disposal and the loop gets closed, when we are recycling the after

the product is used when you are recycling and bringing that again to the process or again to the loop of the material input.

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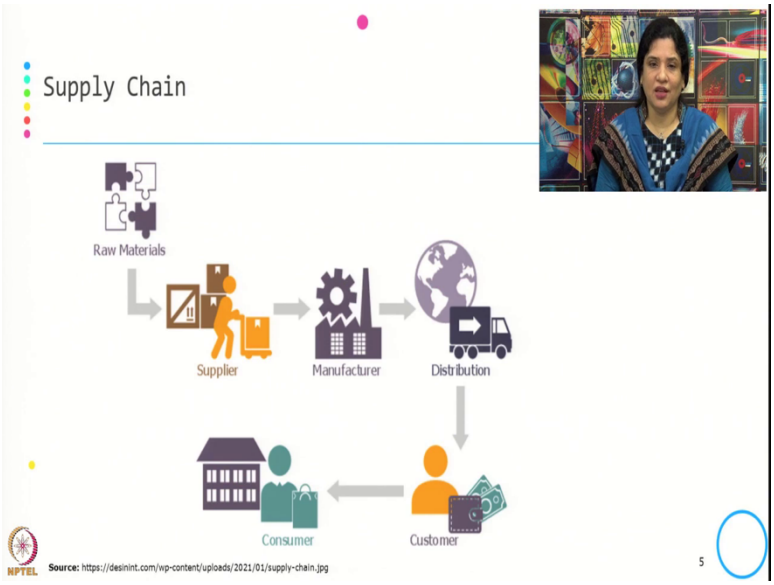

Now, this is the typical supply chain what I was trying to explain in the last slide also. So, this starts from the raw material sourcing, goes to the supplier, supplier goes to the supplier sent it to the manufacturer, manufacturer send it to the it gets manufactured, it send it to the distribution then it goes to the customer and finally, it goes to the consumer. Now, green supply chain typically it asks for the changes in each stage of this supply chain.

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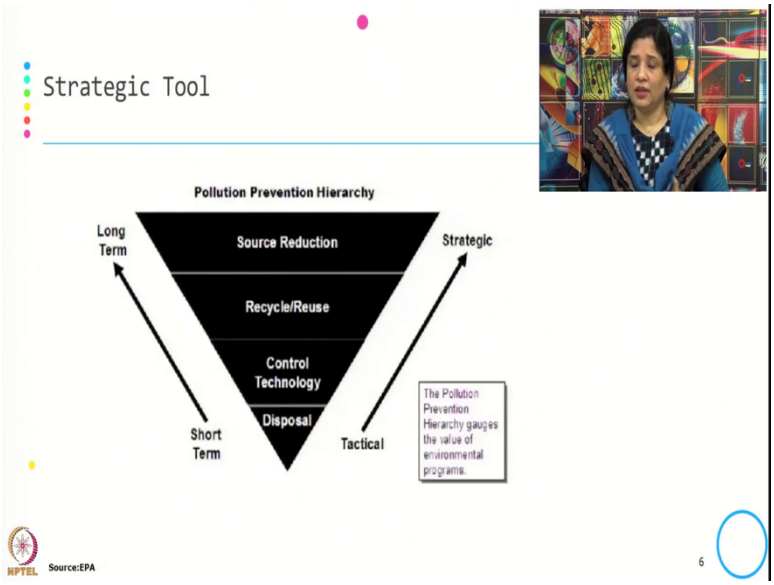

Now, going further there are; there is there are many practices, there are green supply chain practices, many intervention, but this starts from the very popular 3 P's that is pollution prevention hierarchy as a strategic tool to start the GSM practices. So, this pollution preventions hierarchy it talks about source reduction, recycle, reuse, control technology and disposal.

This typically they value the environmental program in each stage of this product starting from the source reduction to the disposal and this moves from short term to long term and also tactical to the strategic. So, the it is not the intervention is tactical, it is more strategic and also it is not a short term one time intervention it move from the long term.

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Now, how to make the supply chain green? The supply chain can be made green by incorporating green in product design, production process, material purchase, packaging, warehousing, logistic and reverse logistic in distribution. So, we will see few of it few examples over here and how what are the practices or what are the intervention which can be done to incorporate the green in this that stage of this supply chain of the product.

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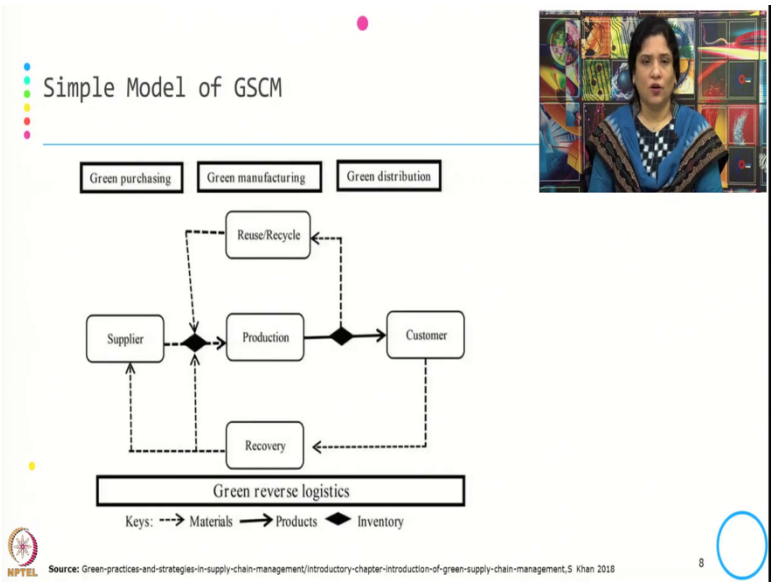

Now, this is the simple model for GSCM where if you look at the for it is more about green purchasing, green manufacturing and green distribution and the at the end of it after the customer uses the product, consume the product, it get gets into recovery and finally, moving back again to the supplier.

So, if you look at mostly the green has to be on incorporated materials, it has to be incorporated in product and also if you look at it has to be also incorporated when the end use happened and the in the recovery mode it goes to the loop again. So, if you look at the production is at the center of it and all these practices green practices in purchasing, green practices in manufacturing, green practices in distribution logistic everything can be planned to make the entire supply chain as green.

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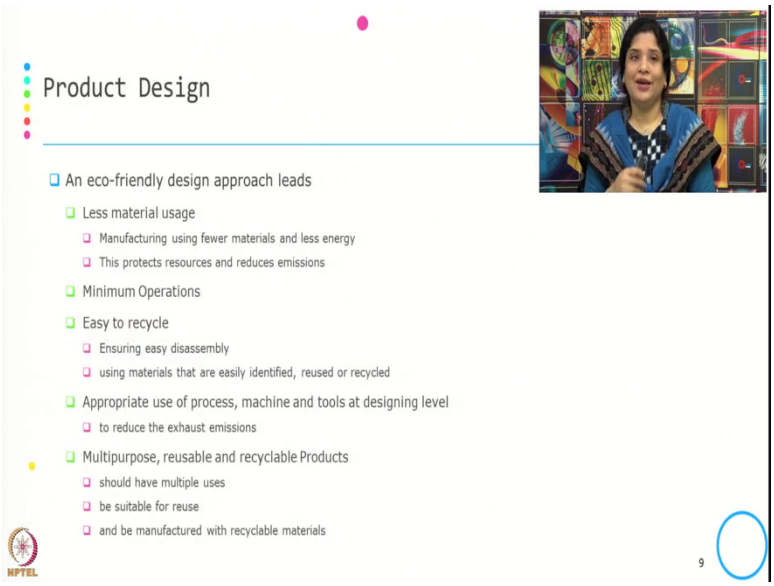

Now, let us start how the green can be incorporated product design. So, typically when we includes the environmental concern into design we say it is a eco friendly design. So, if you remember when we are discussing about the sustainability tool, we discussed one of the design tool or the management tool that is for the design for environment wherein the product design itself the environmental concern gets integrated over there.

So, typically this is a eco-friendly design approach. It leads to less material usage that is manufacturing using fewer materials and less energy and this protect the resources and reduce the emission. Also eco friendly design approach leads to minimum operations so that less operations less is the impact because less is the inputs gets used over there. The typical example is the input in the form of the energy.

Then it is easy to recycle ensuring easy disassembly then using material that are easily identified, reuse and recycle. So, if you remember when we are talking about the Herman Miller chair there from the beginning when the DFE is get incorporated in the design it was very clear that how much percentage of the product can be reuse, how much percentage of the product can be recycle.

So, it is easily identified that proportion of product which can be reuse that proportion of product which can be recycled. So, there is appropriate use of process, machine and tools at the designing level to reduce the exhaust of emission. So, there are use of the kind of

process being chosen, the kind of machine being chosen, the kind of tools being chosen that is from the design level itself which will reduce the exhaust emission.

This can be multipurpose, reusable and recycle product; should have multiple use, be suitable for reuse and manufacture with the recycled material.

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So, there are also some certification added with this sustainable design like C2C which clarifies and foster innovation in sustainable product across five critical performance category that is a material health, material reutilization, renewable energy in carbon management, water stewardship and also social fairness.

Then ISO 14062, this is assess the integration of environmental aspect into product design and development and ISO 14001 that enable the company to certify their commitment to the environment by managing the ecological hazard intrinsic to their activities.

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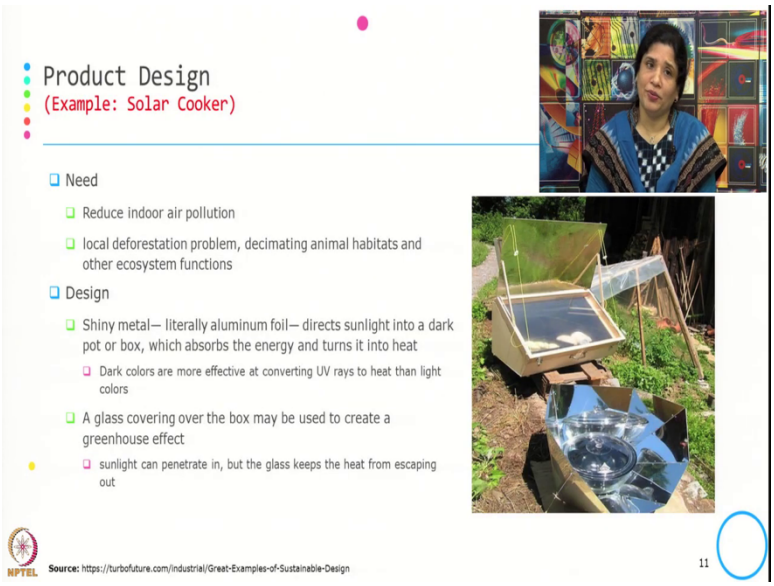

Now, let us take a example of the product design in solar cooker. So, here the product is solar cooker and we will see that how the green is being planned at the design itself. Now, what is the need of the product because we know that when we use the traditional source of fuel for this cooking, this creates the indoor air pollution.

And you will find there are lot of scientific evidence and also the literature that talks about that what is the health impact associated with when we cook with the; when we use the cooking activity with the traditional fuel, because it creates smog and that leads to indoor air pollution which has a health effect.

Now, the need for a solar cooker is that it will reduce the indoor air pollution. Also since it is mostly sourced through the wood when we are going for this solar cooker it will solve the local deforestation problem, decimating the animal habitat and other ecosystem function. And, the bigger economic factor is that whatever the time used for collection of woods and all this thing that can be for the productive use for the female.

Now, how they have designed that? They have use a shiny metal, literally the aluminum foil, direct sunlight into the dark pot or box, which absorb the energy and turn into heat. And, typically the why dark color is being used? Because dark color are more effective at converting the UV rays to heat rather than the light color. Then there is a glass covering over the box may be used to create the greenhouse effect, sunlight can penetrate in, but the glass keep the heat from escaping out.

So, if you look at here the product there is a need for the product and to make it a environmental friendly product, they have incorporated the use of materials, the technology what they have used that they have incorporated from the design itself.

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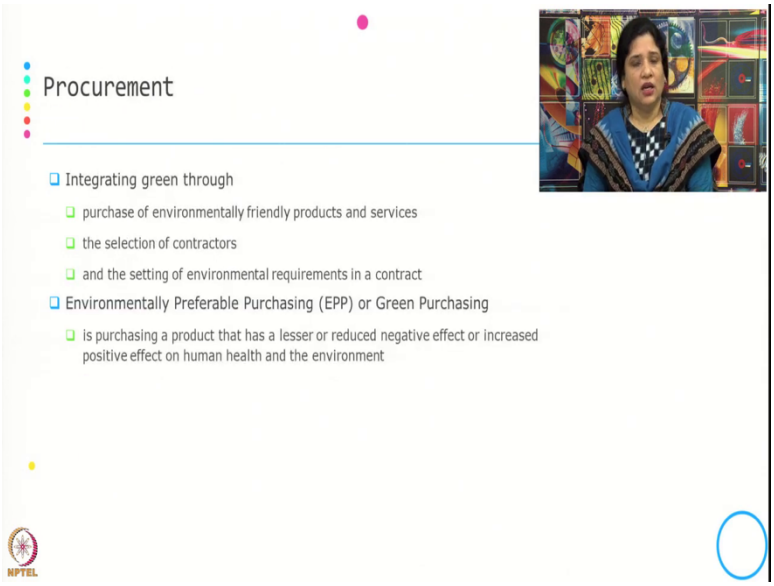

Then going further let us see that how the green purchasing or green can be used through the purchase of the environmental friendly product and services. So, here the green can be integrated through purchase of environmental friendly product and services, the selection of contractor, setting up the environmental requirement in a contract.

So, this is known also as Environmentally Preferably Purchasing; EPP or green purchasing. This is purchasing a product that has lesser or reduced negative effect or increased positive effect on human health and environment. So, this has again. So, you will find there is I think EPPs or ESSP which also talks about it is not only product also this is environmental preferable purchasing product and services where service is also added over here.

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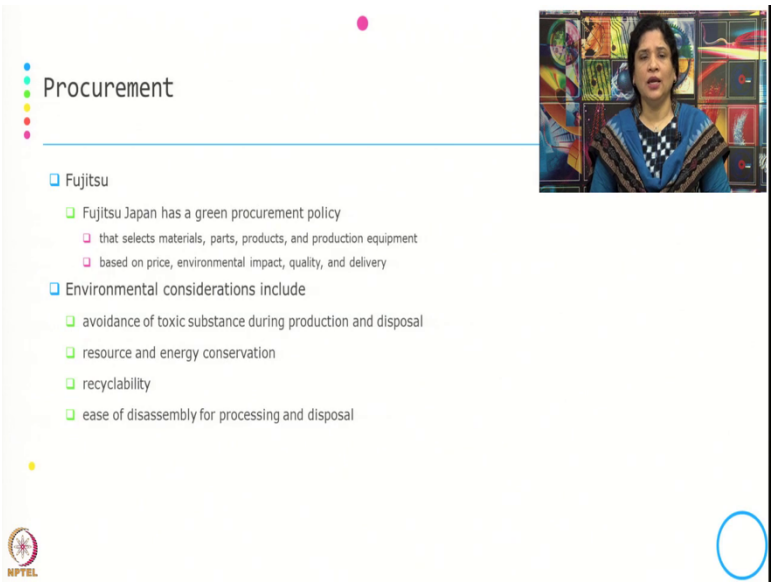

Now, some example few initial example of this green purchasing is that they select materials, part, product and production equipment based on price, environmental impact, quality and delivery. So, this is one of the example. There are you will find that this has become a kind of practice for all the company going for the green procurement.

Now, what includes the environmental consideration when you are doing a green purchasing? This is avoidance of toxic substance during production and disposal, resource and energy conservation, recyclability and also ease for disassembly the processing and disposal.

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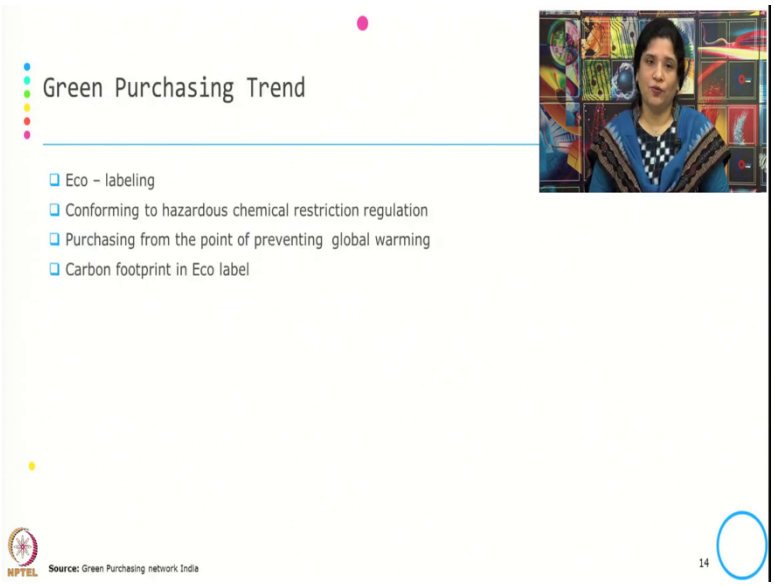

Now, the trend what is happening you will find that how typically this has been planned or how this is this has been practiced as the so called green purchasing practice. So, we will find that when consumer they are looking at eco-lebelling before buying a product one signal that this is a green purchasing trend. Or if you are looking at that whether it is conforming to the hazardous chemical restriction regulation if you are looking for that in the product, then this is another trend for green purchasing.

Then you are making a purchase which will prevent the global warming that is another green purchasing trend and also looking in the carbon footprint. So, while producing the product how much footprint or how much carbon can be emitted and if you are trying to do that in through the eco labelling, then this is the another signal that how you are doing a green purchasing.

So, if you remember when we are talking about eco labelling in your strategy level 3 when you go for level 3 certification there you get in fact, that what is the specific emission which has been created during the process of the product. And, if the consumer is deciding based on that what is the leveling the product is having and accordingly making a purchase then that is a clear signal that the consumer is pro environment and making a or following a green purchasing practices.

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Then let us see how to integrate the green in production and manufacturing process. So, what is green manufacturing? It is the renewal of production process and the establishment of environmentally friendly operation within the manufacturing field. Now, how it can how the green is incorporated in manufacturing or the green aspect is incorporated in manufacturing?

Some of the example can be achieving economies of scale in production, lean manufacturing approach, fuel efficient tools and machines, energy efficiency and using less carbon energy sources, then pollution reduction, removal greenhouse gas reduction and recycling.

So, if you look at whenever the company tries to address the sustainability agenda you will find for most of the company the first thing what they do is that they try to see what how they incorporate the sustainability or green in the production process. So, mostly they see that how the technology can be changed, how the source of energy what they are using how it can be renewable or how it can be less carbon emitted.

So, accordingly if you look at this is the first loop in the supply chain where typically the sustainability agenda is being incorporated.

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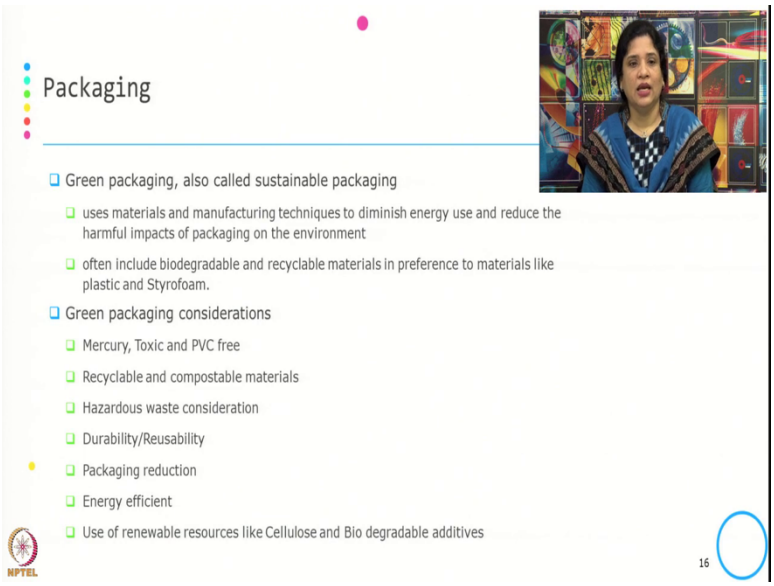

Then we will see how it is done for the packaging. So, there is a green packaging, also known as sustainable packaging and they use the materials and manufacturing technique to diminish the energy use and reduce the harmful impact of packaging on the environment. And, mostly they in use the biodegradable and recyclable materials in preference to materials like plastic and Styrofoam.

Now, few thing what they consider while making a green packaging is that they ensure that the packaging should be mercury toxic and PVC free; they should use the recyclable and compostable material; hazardous waste consideration has to be incorporated while planning for the packaging; the packaging should be such that it is durable and also reusable.

And also the packaging design should be such that there should be reduction in packaging rather than making the unnecessarily packaging, then energy efficient it should be energy efficient and also they should use the renewable resources like cellulose and also biodegradable additives.

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Now, how to decide whether the package is packaging is sustainable or not? So, this is given nicely, explained nicely by this Nature Fresh Farm that why sustainable in the context of that why sustainable packaging is important and this is if in fact, these are the checklist through this we can find out whether the packaging is sustainable or not.

So, first whether sustainability so, sustainable source material is being used for the packaging, whether green disposal options are given in the packaging, whether the packaging is optimized or whether it is also long term cost efficiency. Last one is also crucial because if there is no cost efficiency and if it is just going on incorporating in incurring more cost possibly the company they will not prefer to go for the green packaging.

So, last one is also equally crucial like sustainably source material or green disposal options also we need to see that this has to be cost efficient, then only this packaging is sustainable packaging.

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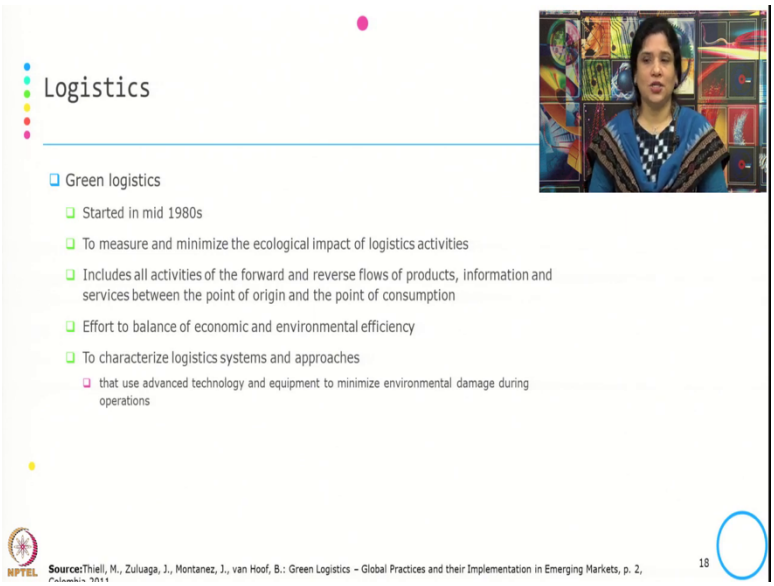

Now, let us get into logistic and see that how the green can be incorporated in logistic. So, green logistics started in mid 19 to measure and minimize the ecological impact of logistic activity and it includes the incorporation of green in the logistic includes all activities of the forward and reverse flow of the products, information and service between point of origin and point of consumption.

And, it effort to balance economic and environmental efficiency and it characterize the logistics system and approach that use the advanced technology and equipment to minimize the environmental damage during the operations.

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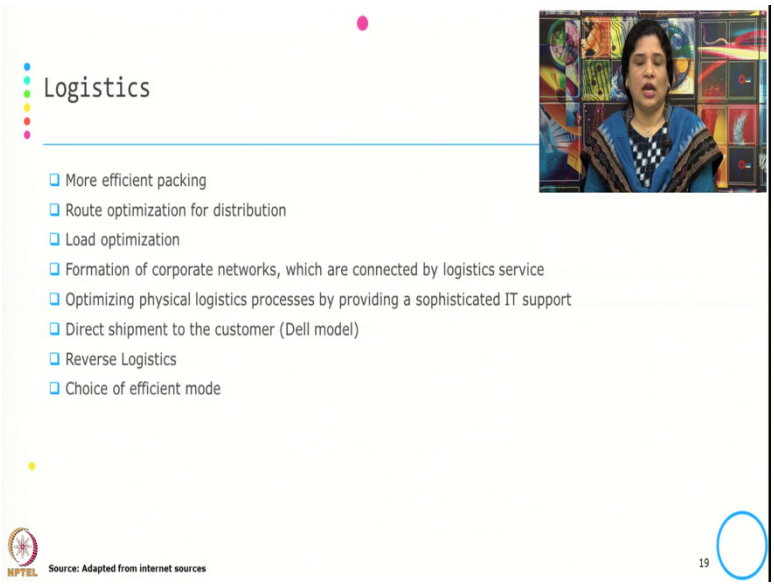

Now, few intervention, few action point through which the logistic can be made sustainable or it can be made green that it should be more efficient packing the way the pack the way the goods are packed into the trucks or the other mode like how efficiently it can be packed.

There should be route optimization for the distribution. There should be load optimization, then formation of corporate network which are connected by logistic service, then optimize the physical logistic process by providing a sophisticated IT support.

Direct the other good model or sustainable model is that rather than keeping a intermediary or third party the direct shipment to the customer so that the trip is from the producer to the customer not through the third party. Then the plan for the reverse logistic and also what is more crucial is that what is the efficient mode of the distribution.

So, the choice of efficient mode; whether it is railroad, whether it is regular surface or whether it is the other mode of transport, what is the mode of transport that makes actually the logistic more efficient or it is more sustainable.

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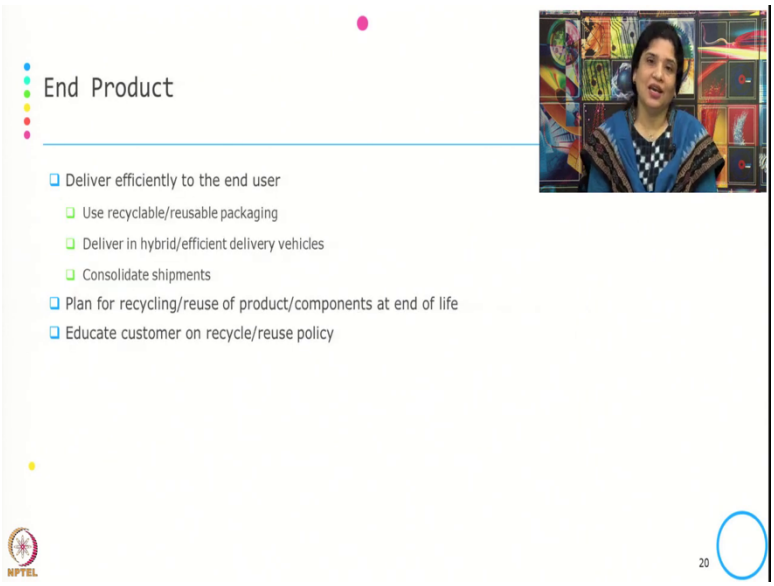

Then let us see how the green can be added in the end product when it is delivering to the end user. So, the efficient delivery can happen by using recyclable and reusable packaging; delivery in hybrid and efficient delivery vehicle, consolidated shipments. Plan for recycling, reuse of product, component at the end of life and also educate the customer on the recycle and reuse policy because once the product is being delivered then it is the consumer responsibility that how to dispose or how to reuse.

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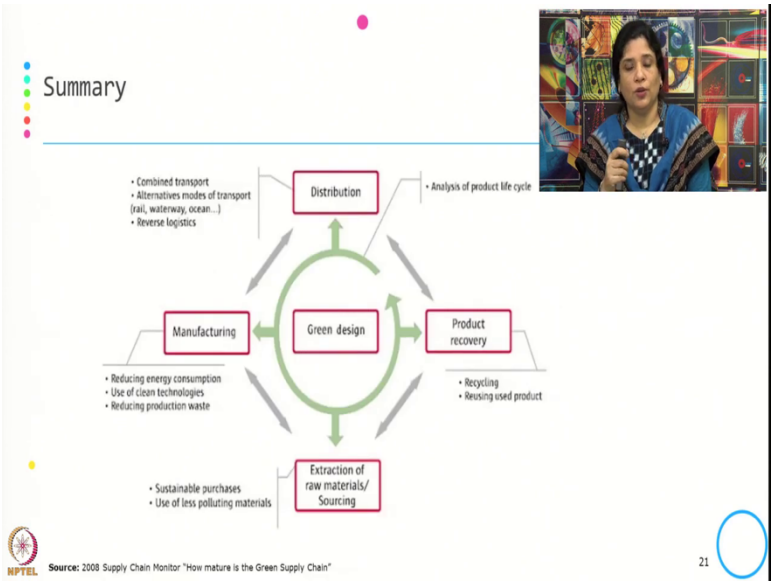

So, if you look at this is how the entire incorporation of green in the different loop of the supply chain is being done. So, if you start with let us say if you are starting with the extraction of raw material and sourcing then the intervention or the action point over here is the sustainable purchases or use of less polluting material. Then in manufacturing to incorporate sustainability, reducing the energy consumption, use of clean technology and reducing the production waste.

Then in distribution, we can bring the intervention of combined transport, alternative mode of transport like rail, waterway and ocean, the reverse logistic and in product recovery the recycling and reusing of the used product and also, the analysis of the product life cycle looking at like how the intervention can be made from each of this loop of this supply chain.

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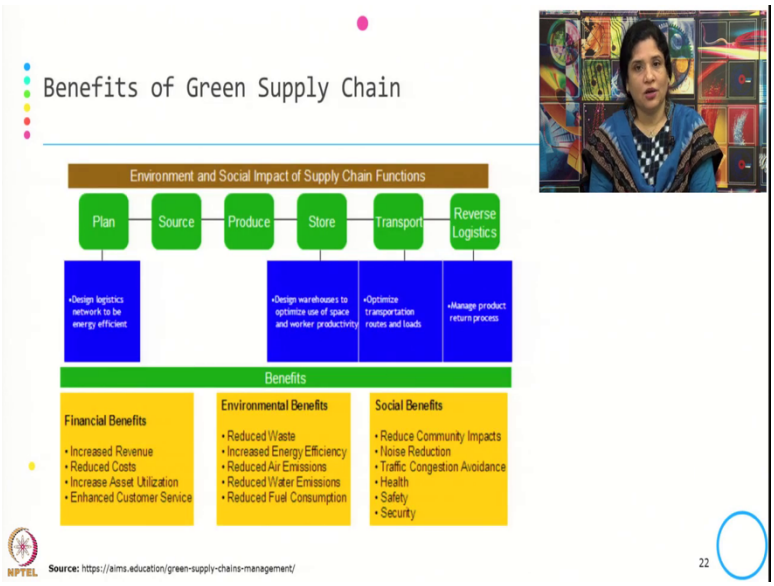

So, these are the because the crucial question over here is that when the organization they use the or they practice the green supply chain management or they practice the GSM the what to say the incorporate green at each stage of the loop of the product supply chain what is the benefit they get. So, if you look at here this figure this shows us the environment and social impact of the supply chain function.

So, what it is done? If you look at the entire supply chain is into plan, source, produce, store, transport and reverse logistic, these are the different loop of this supply chain. Now, this we have been already discussed in the previous slide that what would be the

interventions in each of it. So, starting from plan to the reverse logistic possibly one thing what we did not discuss is that the in the component of store how the green has to be used.

So, here typically the intervention is that design the warehouses to the optimize the use of space and worker productivity and at the end of it what the organization get or whatever the benefits what the company get when they practices the green supply chain management.

So, in term of financial benefit they get increased revenue, reduced cost, increase asset utilization, enhance customer service; in term of environmental benefit it is reduce waste, increase energy efficiency, reduce air emission, reduce water emission and fuel consumption. And, in case of social benefit it is reduce community impact, noise reduction, traffic congestion avoidance, health, safety and security.

So, it is not that it is only incurring cost or incurring effort when we practices the green supply chain green supply chain practices, but it is giving the benefit to the organization in term of financial, environment and social benefit.

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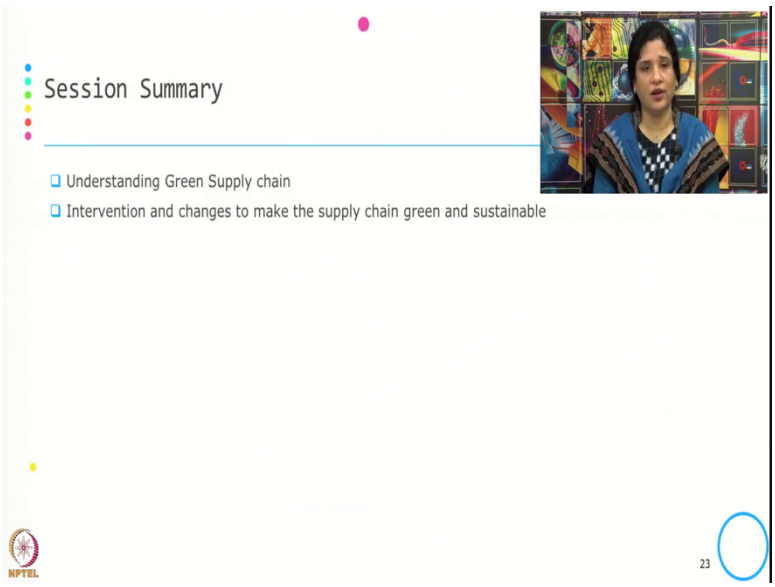

So, in this session we have discussed the or we have understood what it means when we say green supply chain; how sustainability can be incorporated beyond the firm's boundary starting from the sourcing of the raw material, till the end product disposal and again it is bringing back to the loop of the material inputs and also we discussed the intervention and

changes starting from product design till the end product delivery to make the supply chain green and sustainable.

Thank you.