Sustainability Through Green Manufacturing System: An Applied Approach

Prof. Deepu Philip
Department of Industrial & Management Engineering
Indian Institute of Technology, Kanpur
Dr. Amandeep Singh Oberoi
National Institute of Technology, Jalandhar

Lecture – 19
Productivity and Sustainability Continued

Now continuing with the previous lecture that we have talked about on how to measure productivity and other aspects of it, let us talk about another term the quality.

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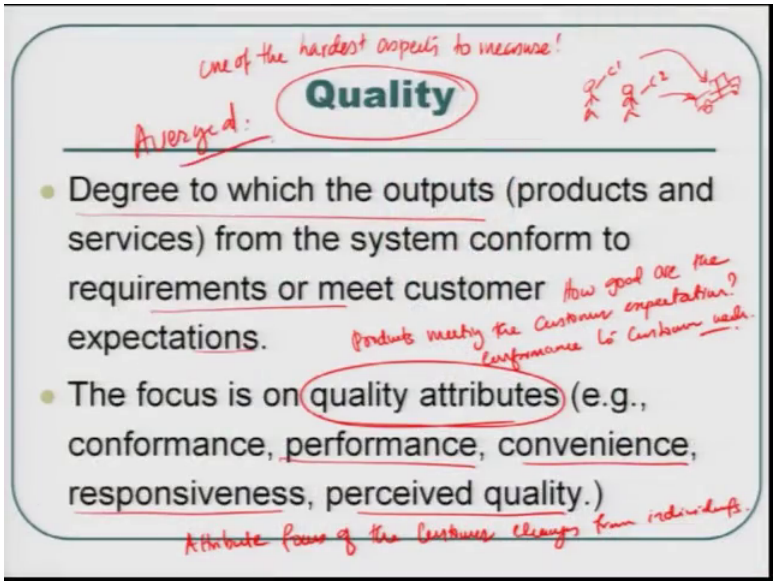

The trick with the quality is that this is 1 of the hardest aspects to measure. So, quality is not very easy to measure, but by definition what quality is it is degree to which outputs from the system confirm to the requirements of the customer. So, how good are the products meeting the customer expectation, this is what we talk about as the quality or in a way it is conformance to customer needs.

It is quite a hard to measure because each customer is an individual person and say if you have 1 customer here and another customer here, both will have this is we called customer 1 and customer 2, they will have different requirements. If your product is the same and we have same car and both the requirements for the same car it might be different. So, like for example, somebody might look at the performance of the car,

somebody might look at the convenience of the car, somebody might look at the responsiveness, the accelerator or they will look at the perception of the quality. So, at the end of the day what will happen is the customer focuses on attributes.

The attribute focus of the customer changes from individual, so once each individual has their own thought processes and hence at the end of the day your quality is dependent on your customer whomever you are dealing with and there is always is always to measure this. But you can always measure the average values of quality that is why we always talk about average quality, averaged values right.

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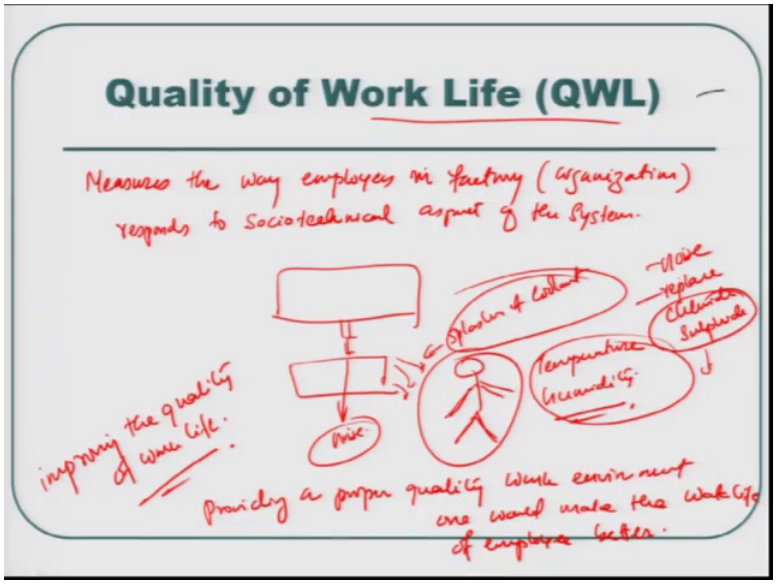

Now, there is another thing that we want to talk about is called as quality of work life QWL. So, what is the quality of work life this is an important concept QWL because the worker who is you know, it measures the way employees in a factory it need not be factory let is called as an organization ok.

Organization response to the socio technical aspects of the system, this is a fancy word. So, I will explain it to you. So, like for example, is if you are using a here is a machine, is doing something let is assume that here is a machine with the drilling bit and here is a work piece and is drilling a hole and employee is standing here. So, he is subjected to what is called as splashes of coolant, then there is a this noise coming from here then the temperature humidity etc all right. So, all this aspects this person is subjected to. So, by

providing proper quality work environment, one would end up one would make the work life of employee better or you would end up improving the quality of work life.

So, how does the employee response to all these you know aspects or a subjected to him, this quality of his work life is also an important consideration in sustainability because at the end of the day, you have to take care of this human being as well. So, in our class also some other experiments will talk about how do we measure noise, how do we measure you know how do we replace chloride and sulphide based coolants, which are mineral oils to something that is more compatible with the skin and other aspects of it. So, those kinds of aspects we will actually see in this course as well. So, the quality of work life is also an important aspect of sustainability. Then we comes the fancy world called innovation, everybody talks about innovation and what is innovation and those kinds of things. For the sustainability aspects, what we call it as it is a measure of the applied creativity in the system.

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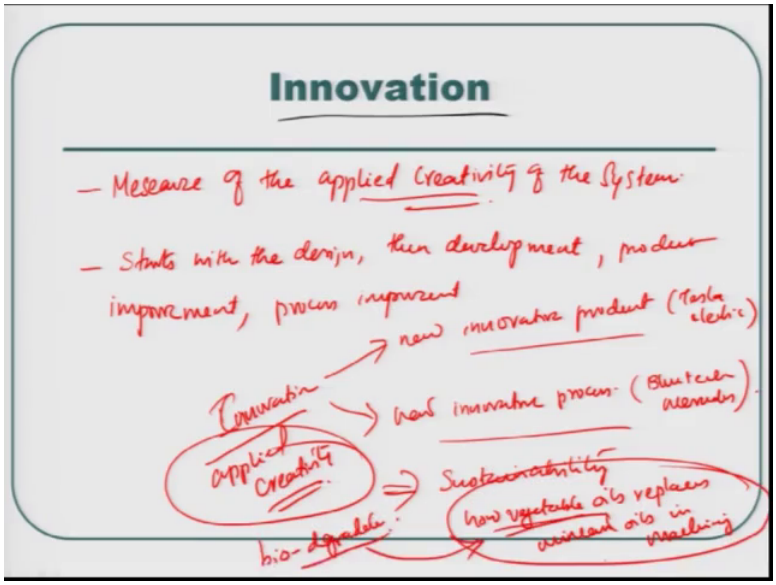

From sustainability is 10 point, this is how we measure innovation here the applied creativity, how is the applied creativity is going to work out that is what we are trying to do. So, what is it is basically what do, we do it starts with the design, then development then product improvement and process improvement. So, you can have a new innovative product an example of this is tesla electric car this is the new product or you can have a new innovative process, which is what we can actually talk about it is a you know blue

tech car by is an Mercedes because what is the do is there using the same gasoline and other things.

But the emissions of it is so clean that the car is basically you know you can say that, the car is running on water kind of a thing because it is not it is polluting which producing of pollutants. So, those kind of aspects you have you can have both of the product and process, but the idea is that how do you. So, here is a we call as innovation or you call it as applied creativity, how do would you create new solutions the problem and applied creativity is quite important to sustainability because in this class we will see how vegetable oils replaces mineral oils in machining. So, this is where you are replacing you are coming up with the new alternative product, which is this is biodegradable.

So, the vegetable oil is biodegradable, whereas the mineral oils they are non biodegradable. So, hence the innovation here is how did we is an applied innovation, where you end up changing the mineral oil with the help with non biodegradable mineral oil, with the help of a biodegradable vegetable oil ok.

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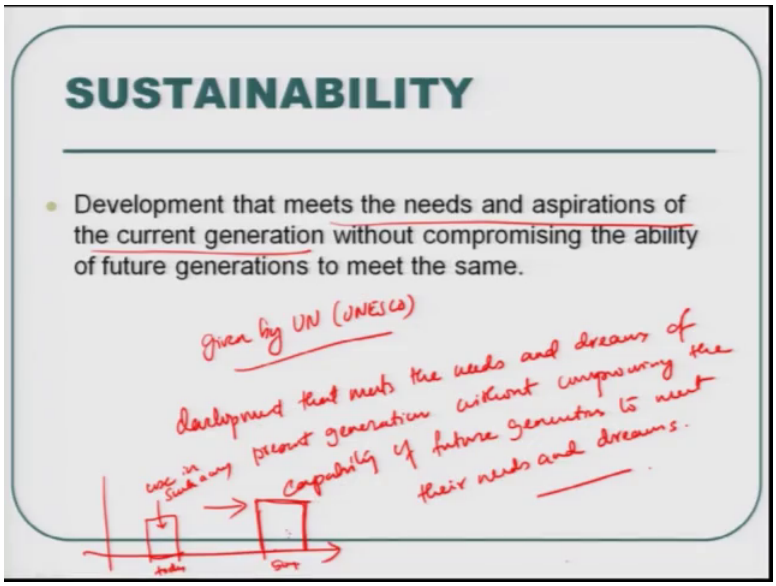

So, that is innovation for us then we talk about sustainability. So, we seen tern seen this term sustainability and we discuss this in many ways. So, formally we will once again define sustainability this is the definition that is you know, given by u n an UNESCS. You talk about any agencies who are working in the sustainability angle; they use this at the development that meets the needs and aspirations of the current generation or

development that meets the needs and dreams of present generation or current generation, without compromising the capability of future generations to meet their needs and dreams.

So, what you trying to do is you are doing something today. So, if you think about it in a time scale. So, let is say this is the present generation and you are doing something in today and then let is say 50 years down the road, they should still be able to do, they might have wondered have a dream of doing this and we have no right to prevent their dreams of doing this, this is what the sustainability means, so whatever we use here use in such a way that future also gets an option to use it ok.

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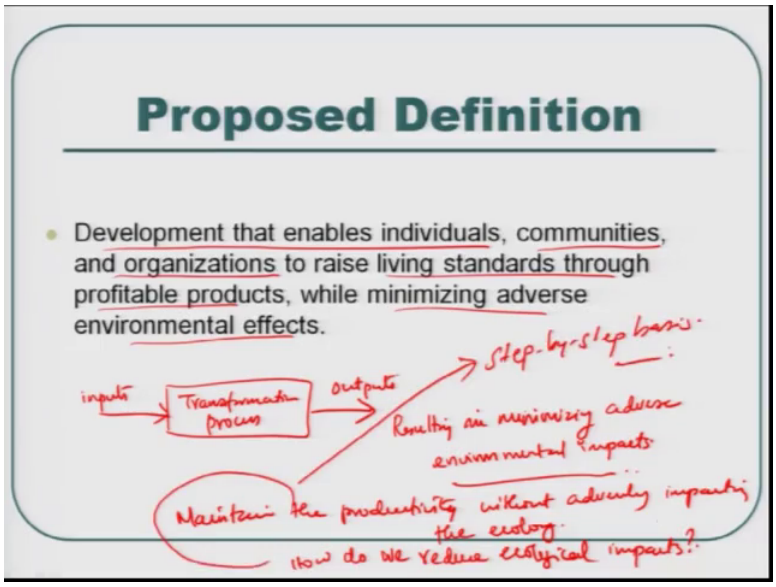

So, that is one aspect of the sustainability this is the general process, for this course purpose this particular definition of sustainability, the propose definition here is that the development that enables individuals, communities and organizations to raise living standards through profitable products, while minimizing adverse environmental impacts.

So, our aim is that you have a transformation process, which has inputs and you have outputs. So, what we are trying to say is that you do the in outputs, but at the same time you look at different strategies of dealing with the input and resulting in minimizing adverse environmental impacts. So, the focus of this course is to a large extent, how to we maintain the productivity without adversely impacting the ecology or the

environment or how do we reduce ecological impacts. How can we do this on so the thought process theories, how do we achieve this on a step by step basis ok.

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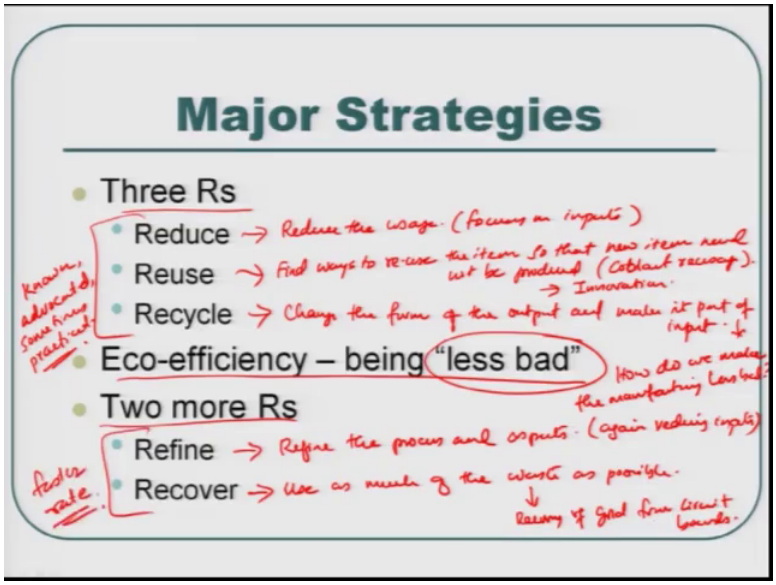

That is the thought processes of this course all right. So, the major strategies there are lot of these strategies, there are followed by people the first one the 3 RS that we talked about reduce, reduce the usage it can be inputs mostly this is focuses on inputs. This is reuse means find ways to reuse the item. So, that new item need not be produced the example is coolant recycle reusing re usage, this use to a large extend it results it requires. what you call as innovation aspects of it recycle basically change the form of the output and make it part of input. So, this is another way if you recycle then your requirement of the input.

So, your again trying to reduce the input aspect of it. So, these 3 strategies reduce reuse and recycle these are known advocated and sometimes practiced. This is the reality among this, what we are trying to focus in this course is we are talking about being efficient, but we are talking about eco efficiency. How can we make the system being less bad that is the concept, how do we make the manufacturing less bad how do we do that. So, then for that we propose 2 more add 2 more RS which is refine the process and aspects.

So, that you are you know you are again producing inputs recover means use as much of the waste as possible not necessarily, just means like for example recovery of gold from

circuit boards is an example of this case. So, if you add these 2 also to this then you can actually reach sustainability at a much, this will make it at a faster rate that is the thought process of this all right.

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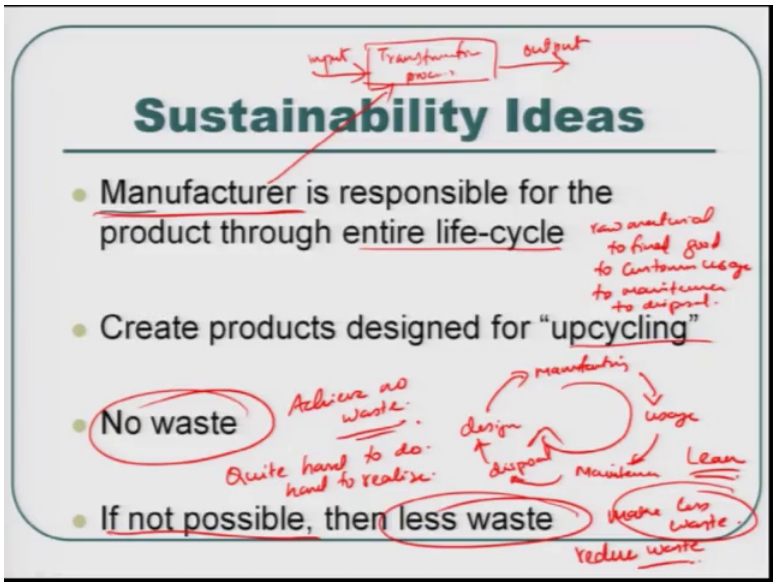

So, some of the ideas that is related to sustainability is that you know, the first thing that the one should understand in this case is the manufacturer, if you think about it again your transformation process here is the input here is the output.

So, when you say manufacturer it is this is what you are talking about, it is responsible for the entire life cycle of the product. So, from the raw material to final goods to customer usage to maintenance to disposal, so the life cycle of it is you basically you can think about it has design, then manufacturing, usage, maintenance, disposal and if you can do that you can bring the system back again into the cycle. Then that is where you actually do the better aspect of it. So, that is also other thing aspect is that you can also think about it as sub cycling, you can think about the cycle been completed this fashion.

So, the idea is that achieve no waste, obvious easy to say achieve no waste, but most of the time this is quite hard to do or hard to realize. So, if not possible then what you do, make less waste, reduce waste, which is to a large extent sometimes lean manufacturing also talks about it the principle of lean is reducing of the waste in the system. So, but here we are not just talking about waste, but the waste is one aspect of it is a much bigger system than just reducing the waste ok.

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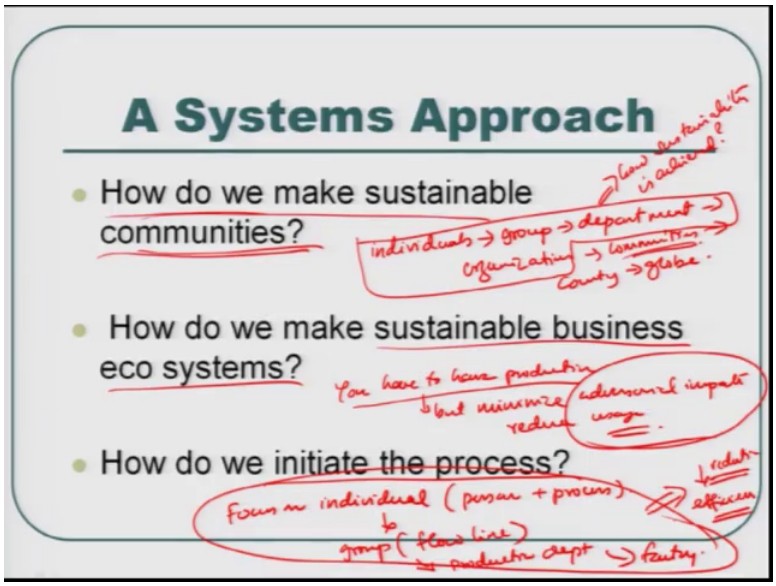

So, let us think about it in a systems view point and then we will look into some examples of it.

So, the systems view point here basically says that, how do we make sustainable communities that is 1 question. So, we can see remember we talked about individual to group, to department, to organization, to communities, to country, to globe this was our thought process. So, what we told about this yes we will we were focusing more on up to the organization side and realize how sustainability is achieved or realized here, this is what you are focusing on. But if we make sustainable organizations then they should translate what you call as sustainable communities.

So, that is 1 approach a systems approach that we are taking in this class, how do we realize sustainable communities and then once you do that when you focus on this then the second part of the question comes in, is how do you make sustainable business ecosystems or you have to have production, but minimize adversarial impacts, reduce usage etc. So, what we are trying to do is yes you have to have production, but at the same time produced in such a way that, you are minimizing the ecologically impact and how do we do this? how do we initiate this process and in the following lectures you will actually see how do we focus on individual, it can be person or a process, from there we talk about a you know group or a we will say flow line or something like this, from there

we talk about what we called as a production department, from there we talk about a factory.

So, this is the way how do we sequential moved through this chain, to ensure at each time we reduce the in reduction of inputs is one example or why how do we increase efficiency of the system. So, that you can produce the same at least with the reduced inputs, so how do we do the how do we initiate the whole process, is what you will see in the lectures that are coming in this course.

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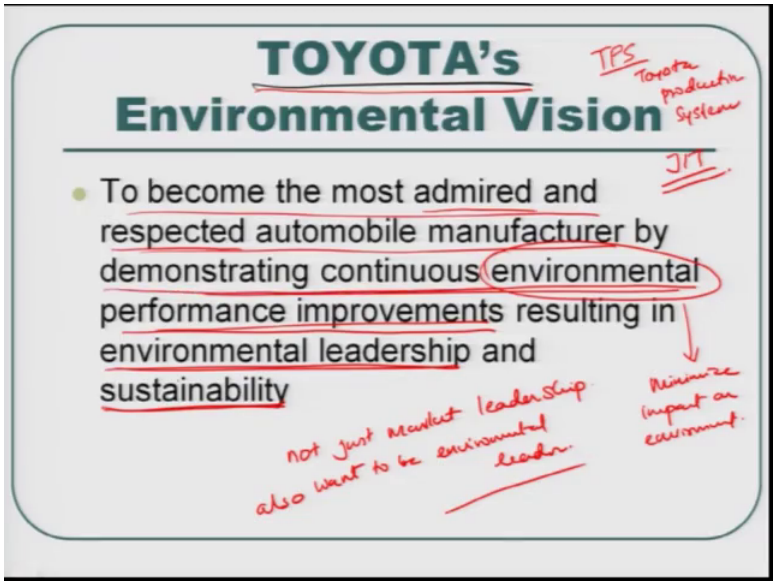

So, I will give you few examples of this because it is very important to know how certain companies as achieved this. So, let is start with a company called Toyota. Toyota is a Japanese company and automatic manufacturer, I believe almost everybody knows about this company and the Toyotas environmental vision, they make automotive cars; you know very good durable cars, there also you would kind about probably if not I am recommend you to do about TPS which is called as a Toyota production system, which is more focused towards what is called as JIT just in time technology ok.

So, how they talked about reducing inventory and all those aspects is part of it. So, the Toyotas environmental vision is they wanted to become the most admired and respected automobile manufacturer. How are they going to achieve that how are they going to become the most admired most respected automobile manufacturer, it is by demonstrating continuous environmental performance improvements. So, you are going

to continuously demonstrate that you are meeting the environment, you are improving your processes from the environmental angle, you are trying to minimize the impact of minimize impact on environment and resulting in so that way they will resulting in environmental leadership and sustainability.

So, their aim is to actually make the production process sustainable or sustainable in a sense that you become a leader, is not just market leadership that is the a important aspect that Toyota said. You just do not want to be just market leadership; we also want to be environmental leader. So, this is what Toyotas thought process was, Toyota said fine we want to actually become the environmental leader by demonstrating, how we do this by demonstrating continuous environmental performance. So, how did Toyota actually ended up doing this.

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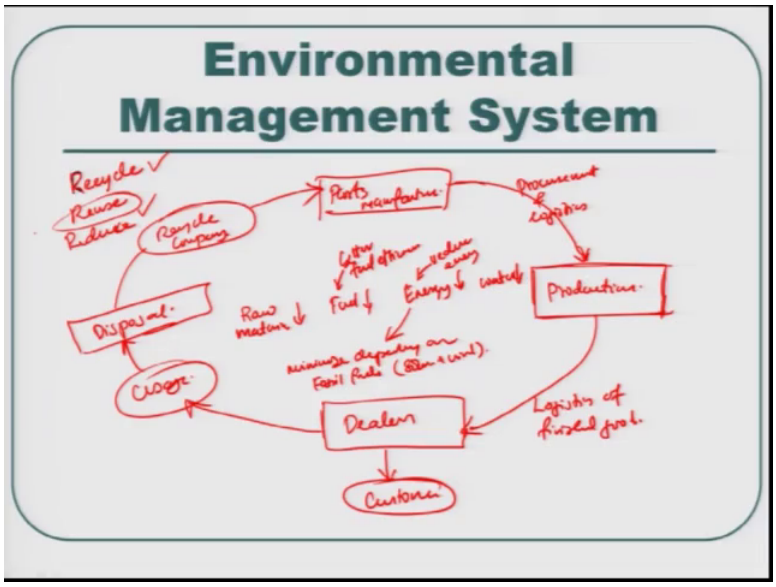

So, the Toyotas environmental management system typically, they started with the re they started with the recycle reuse and reduce.

These were the things that Toyota followed, how did they follow this; say if we draw this diagram so they have there you know think about this as their parts manufacturer. They started from there then you have you know the systems come into what you call as that is your production. So, you have procurement and logistics here. So, they focused on how can we ship items also with minimal truck ship truck loads and then there we have what

we call as the production then they have dealers. So, they are the once who are interacting with the customers. So, after the production it gets transported here.

So, here is logistics of finished goods, then from there the what do the customer do, so the customer which is a part of this, so they use this. So, we will call it as usage. So, this requires some you know then the customer will dispose, let is called as the disposal process and from the disposal they have created a recycle company and the recycle company when then again will supply to the parts manufacturer. So, here the main aspects would be you know raw material, so they focused on raw material the reduction of the raw materials, they focused on fuel which is the better fuel efficiency and they focused on energy, reduce energy or in other way what they are also looked into is minimize dependency on fossil fuels.

So, you look they looked for solar plus wind energies like that on or renewable sources of energy and then they also looked at water reduction of water consumption. So, Toyotas focus was this way. So, they focused quite a lot more on reduce and whatever possible reduce and recycle were the 2 things and certain cases they are reused. So, I will give you an example of what they ended up reusing in other aspects of it. So, this is the Toyotas environmental management system and waters some of the outputs of this tangible measure of whom tangible measures of again. I apologize is color changes frequently of Toyota, what are the tangible measures the Toyota came up average energy consumption were vehicle produced.

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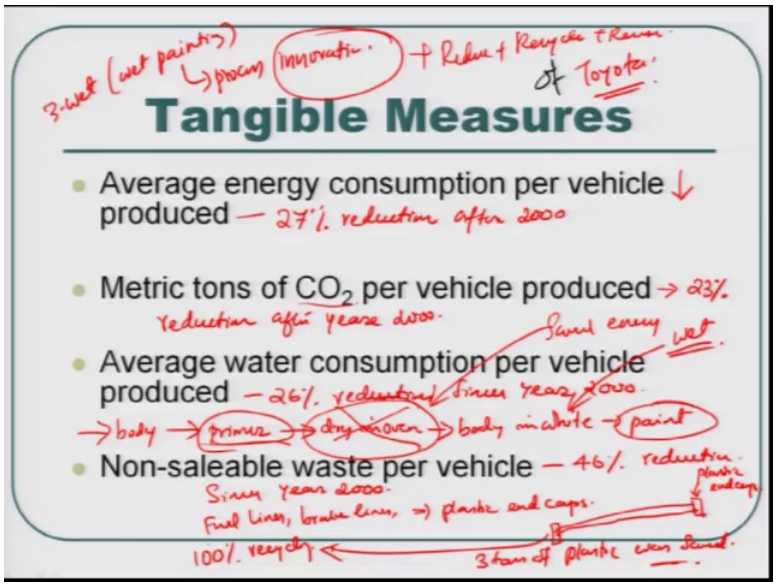

This was there was about a 27 percentage reduction after 2000. So, they have reduced the energy consumption metric tons of carbon dioxide to per vehicle produced, they were able to reduce 23 percent reduction after year 2000. So, this was the tangible measurements. So, how much of carbon dioxide per vehicle produced, they ended up they were able to reduce by 23 percent, average water consumption this was reduced by 26 percent reduction since year 2000.

So, per vehicle there is produced 26 percent reduced in water consumption and non saleable waste produced per vehicle 46 percentage reduction since year 2000, an example of this is and most of the tubes that is used, like the fuel lines break lines etc. The tubes of what you called as plastic in caps to prevent that dust and other things greens do not get into the tube. So, it is like a tube and you have 2 end caps 2 plastic end caps. So, these are the plastic end caps so what Toyota ended up doing were they ended up 100 percent recycling of this. So, typically people through this end cap away and then assemble it, but they collected this end cap and then they recycled it. So, 3 tons of plastic was saved.

So, this is an example of how Toyota realized in our achieved, what we called as environment sustainability through this process and also I before this there is also 1 more thing I want to mention about Toyota is that, Toyota try to do 1 thing which is called as the 3 wet or wet painting approach, this was a process innovation. So, what happens is

the painting process typically I will kind a draw it here, the painting process is the body then comes to the primer, then dry in oven, then becomes body in white and then paint this was the process. What Toyota did was they basically said the once you do the primer forget this dry in oven and just paint the primer directly.

So, that when you are the paint the body in white is this is wet it is no longer dry. So, they came up with an innovative process, how to realize how to paint the color on the body in white which is the primary which is not dry it, in the process they actually remove eliminated this drawing process which saved a lot of energy; which is electric oven. So, these kinds of things, so this is also where they are building innovation into what you call us the concept of innovation plus reduce, plus recycle, plus reuse were the strategy that Toyota used to realize environmental leadership or environmental sustainability.

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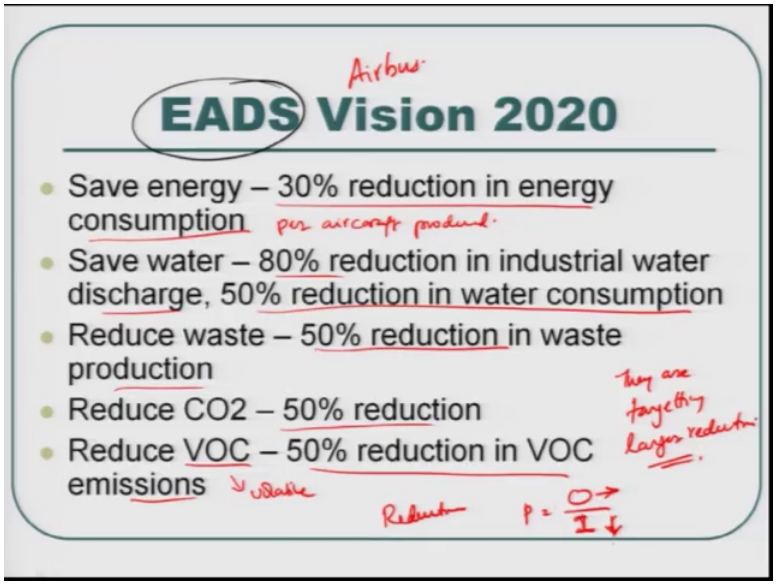

Similarly, the other company that we talk about it is EADS; the most common name is European aerospace and defense. So, people typically know about this in a much better form name called as airbus. So, airbus vision 2020 says that, they would reduce like to reduce 30 percent reduction in energy consumption per aircraft produced and then there want to reduce you know 80 percent reduction industrial water discharge and 50 percent reduction in water consumption per aircraft, 50 percent reduction in waste, 50 percent

carbon dioxide, this is VOC is the volatile organic compounds 50 percent reduction in VOC so this was EADS vision.

So, if you see that they are targeting larger reductions. So, you can see that they are focused more towards what we called as now reducing. So, strategy of EADS is reduction or if you talk about productivity the output over input, the EADS aim is to do this while maintaining the same output.

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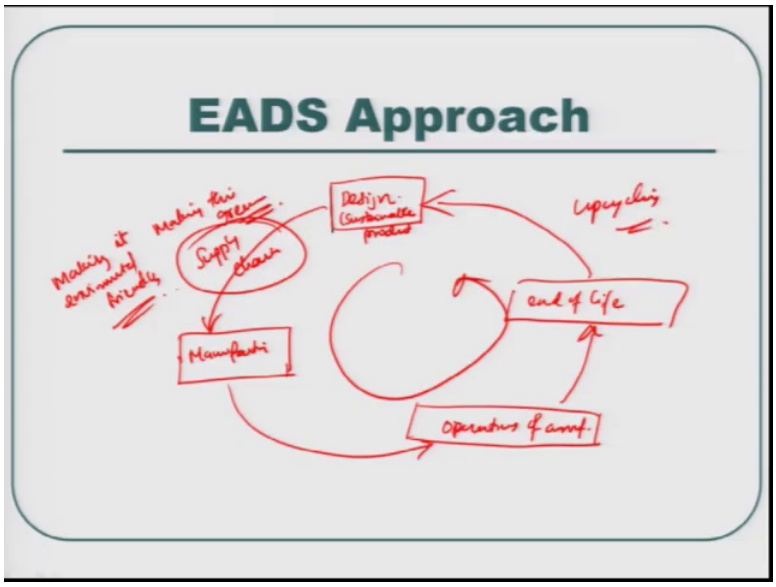

If the output by the time reduce the inputs; so, how do they how are they planning to do this well they are approaching this the first phase, the first phase being the design. They design the products in itself which are you know eco efficient or uses design a sustainable product.

So, then once it is happens is if you have the product from there you do what you call as manufacturing, you do this is called as a supply chain. So, they were focusing on making this green or making the sustainable or making this green in the sense making it environmental friendly. So, that what this is about, then once happens is that we focus on what you call as the operations, the operations of aircraft and then from there once you have the end of life, we moved to then again that Toyota cause in you do the EADS and so then you can see that they completed the cycle.

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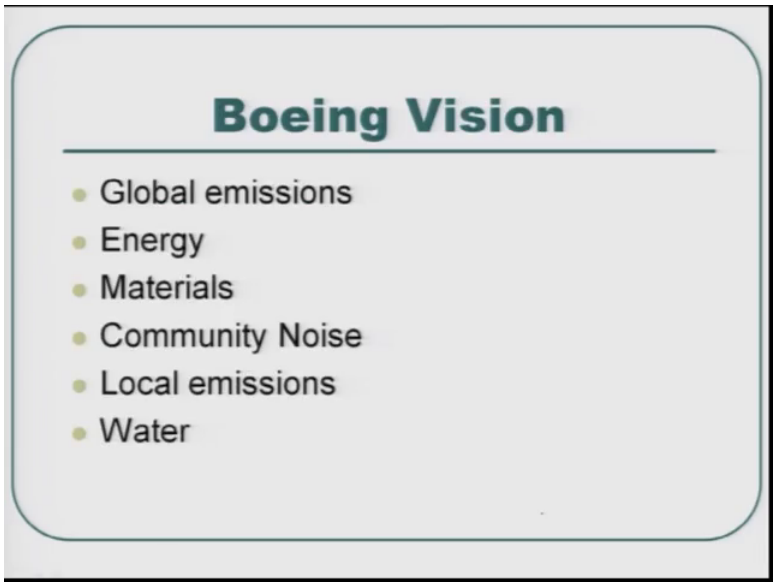

So, the up cycling was also done as part of this, then similarly Boeing is another company they had large targets and this regard. So, their aim was to actually we will talk about the Boeing targets. So, they want to reduce the global emissions energy etc.

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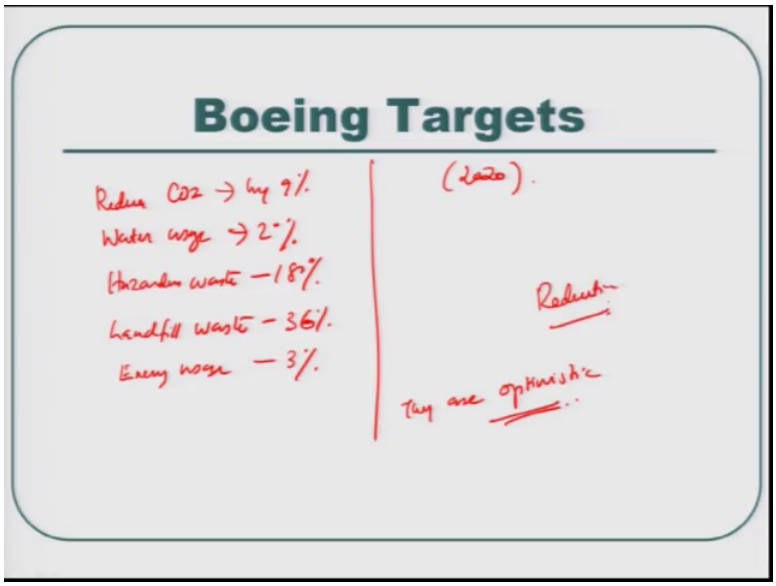

So, they wanted to reduce CO 2 by 9 percent, then water usage by 2 percent, then hazardous waste by 18 percent and landfill waste they wanted to reduce 36 percent; this was again that 2020 vision if you think about it and energy usage 36 percent 3 percent.

So, we see they are not really very you know they are optimistic in this regard, but uncompared to airbus Boeing try to create a much more simpler target in this regard, but at the end of the day still, they are in the focus of reduction. So, is not that sustainability is not being followed by organizations, it is followed by organizations companies like Toyota, airbus, Boeing all pay attention to this. So, how do we can say that is the more important aspects of it? So, I hope that you gets understood the concepts and why it is important for that and we will see how to do optimization in the next class the meantime enjoy reading.

Thank you.