System Design for Sustainability
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Week – 12
Lecture – 3A
Design for Sustainability – Concluding Lecture

Hello everyone. So, now, we have reached the end of this particular course. So, it is the good time now to summarise and create the connections. So, the aim of this particular lecture and the next lecture will be to create the connections, to do a reflection on what all we have learnt till now.

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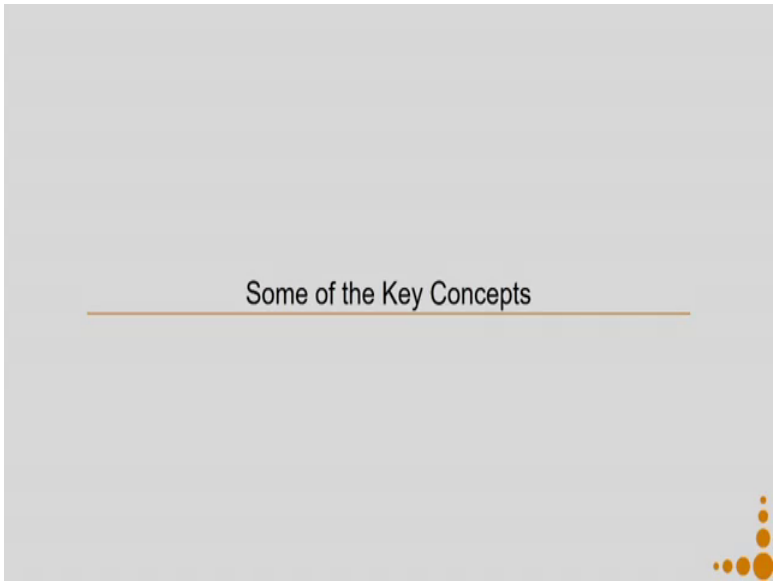

So, some of the key concepts that we have been discussing till now was the most important key concept which we started with from the beginning itself was, it is not about how we produce, but it is more about how we consume that determine sustainability and unsustainability.

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So, in our first lecture in the first week of this course we were trying to discuss about various unsustainabilities and then try to understand ok, if we have to counter act that what is sustainability. So, we realise that we can create more and more efficient products like the example of this 5 star air conditioner which we have taken a multiple number of times. We can make something more and more energy efficient which means, we are only intervening and the product level at the production level and when it comes to the consumption of electricity during the lifetime. But that does not bring in sustainability, why because since the energy consumed the energy bill as a result of it reduces people will buy more and more of this production.

Hence, unsustainabilities are mostly linked with consumption pattern. So, if we have to bring in sustainability, we have to not only concentrate on making processes more energy efficient making processes less polluting, but our major focus has to be on how to make consumption sustainable.

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So, in this context one of the strategies that we discussed was about the concept of unit of satisfaction.

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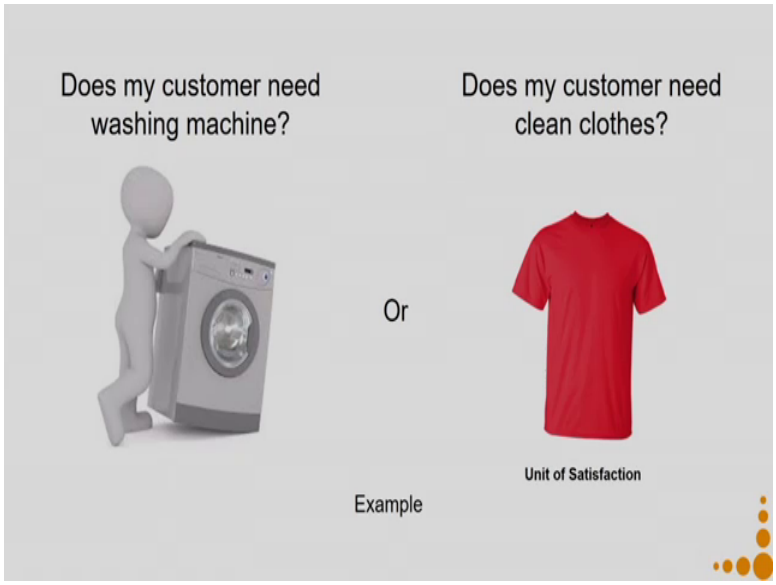

So, rather than making new washing machines, making more energy efficient washing machines, making less polluting washing machines our focus can shift to understanding what actually people do need, what is the unit of satisfaction. Does my customer need of washing machine or is it that my customer needs clean clothes.

When we change our design approach we will be able to bring in better sustainabilities. So, when we were discussing about the entire product plus service system design, we were trying to reach sustainability through this particular idea. So, in product service system design what you try to do is rather than getting into designing more efficient products in to begin with what you try to do is go back to the base question; what is it that my customer need, what is the actual unit of satisfaction, can I give the satisfaction through a product plus service combination which will be environmentally beneficial? Also when we were trying to understand start understanding the whole concept of sustainability we spoke about three dimensions of sustainability.

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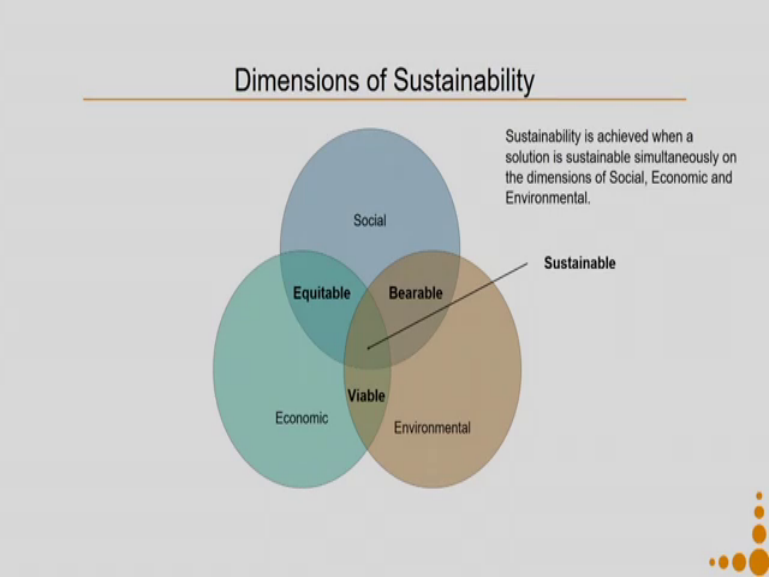

And we said that sustainability lies at the confluence of the three dimension; social, economic and environmental. When we can bring in only the confluence of any of 2 of these dimension so, socially sustainable and economically sustainable, but not environmentally sustainable what we have is a equitable solution. But all these equitable viable and bearable solutions they are good of course, but they are not sustainable in the long run. So, for sustainability to happen it has to be at the confluence of three dimensions.

Now, try to recall our MSDS methodology, or the tools and methods from the agriculture context or the circles of sustainability that we discuss while we were trying to discuss about tools from the domain for making more sustainable cities and settlements. All of

them had dimensions which were divided into social, economic and environmental and all of them were trying to achieve the same thing; achieve a confluence of all the three dimensions. Not necessarily that you have to achieve all achieve equal amount of sustainability on all the three dimensions that is not feasible that is not possible. What we try to do is, how can we bring in the highest degree of sustainability in each of these dimensions.

So, that is why when we discussed also discussed about the life cycle assessment based approach which was purely concentrated on the environmental dimension. So, it is spoke about environmental sustainability. We also spoke about carbon footprint, which was also concentrated on the environmental dimension only. Of course, both of these help to bring in environmental sustainability, but what they do not bring in is overall sustainability because what they are missing is the social and the economic dimension.

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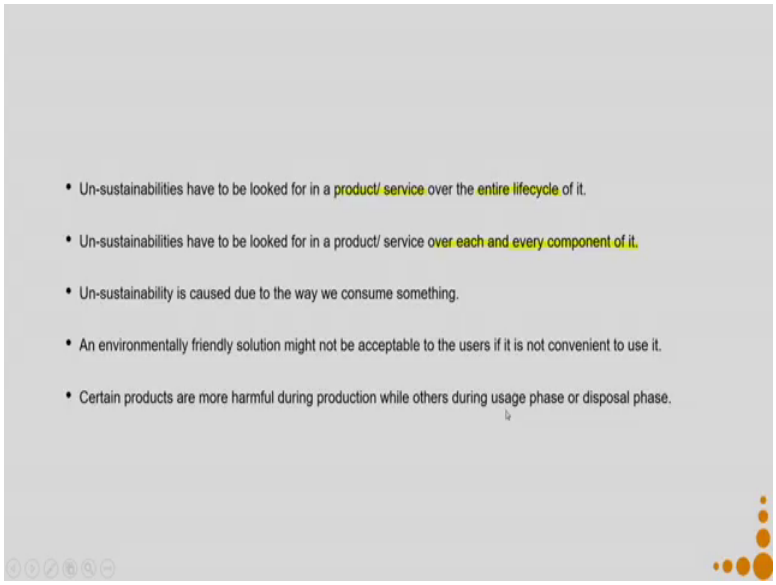

We also discussed that when we are talking about un-sustainability, we have to look it in a in the entire product, we have to look for it in the entire product service system. So, we also discussed that when we are talking about un-sustainability, we have to look for it in a product or service over the entire life cycle of it. So, it is not only during the production time not only during the raw material extraction time, but also during the consumption side. And what happens when disposal has to happen?

Say for example, tetra pack that is a great solution. It can package food and keep them increase their shelf life to a very very long time frame, but that is only up to the consumption side. What happens at the disposal side? Currently there is no mechanism to collect back all those tetra packs by municipalities and so on. And hence all the precious material which goes into making a tetra pack, which is layer of aluminium, plastics and paper goes into a land fill.

Also un-sustainability have to be looked for in a product or so, service over each and every component of it. So, say for example, a product is overall very sustainable. Say a new lighting solution, it is overall very sustainable because it consumes less energy. Say that lighting source is also very long lasting. But I am using some extremely toxic chemicals inside that light emitting source. So, all though the product is very easy sustainable when we talk about the electricity consumption, when we are talking about the life of the product, but where it lacks is the toxicity and when the product will go for end of life it is going to create huge environmental problem.

Hence, un-sustainability has to be looked for in a product service over each and every component of it. Now, again try to think back of all the tools that we had discussed. The MSDS tools, agricultural tools, the tools from per design of cities, the circles of sustainability; all of these tools did have all the life cycles into their consideration. They spoke about toxicity, they spoke about energy consumption, material consumption, design phase, use phase, production phase and so on. Un-sustainability is caused due to the way we consume something and as a result of which we discussed how the product service system design.

Because its main aim is to look at the consumption, to redefine the consumption all together. So, as a result it has very very high sustainability potential. Then environmentally friendly solutions might not be acceptable to the users if it is not convenient to use it. This is an extremely important aspect to keep in mind all the time. So, if I tell you that do not change your mobile phone for the next 10 years, you will not accept the idea just because of the fact that it is more sustainable to do it because for the next 10 years your mobile phone is not going to be technologically viable solution it is not going to give you all that you require.

Hence, an environmentally friendly solution has to be convenient to use, it has to be also be acceptable to the consumer. So, while you are designing something you have to keep in mind this very very important rule of thumb. Certain products are more harmful during production while others during usage phase or disposal phase. So, different considerations have to be given depending on which phase they are more harmful. This is what is this in order to do this aspect you have to do the life cycle assessment of any particular design solution that you make. You have to also do a life cycle assessment of the existing scenario which helps you to identify during which phase what are the harmful processes or harmful sub products or harmful products involved and then make appropriate design changes.

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Next our concern was to discuss on what is sustainable development. So, the concept of sustainability and sustainable development are very very linked to each other. Why do we want to achieve sustainability, because we want to go for sustainable development of the world. So, many a times there is a conflict, there is a idea that sustainability wants us that we start living like by consuming less, by going back in ages, but that is not true. So, that is why the whole concept of sustainable development.

So, it says that sustainability has to be achieved in a manner that we are progressing at ahead it does not mean that we have to go back in time. So, sustainable development is defined as development that meets the needs of the present without compromising the

ability of future generations to meet their own needs. So, we discuss that when we are trying to discuss this particular idea of sustainable development that is meeting presents need without compromising the future generation, we had 2 key concepts in mind.

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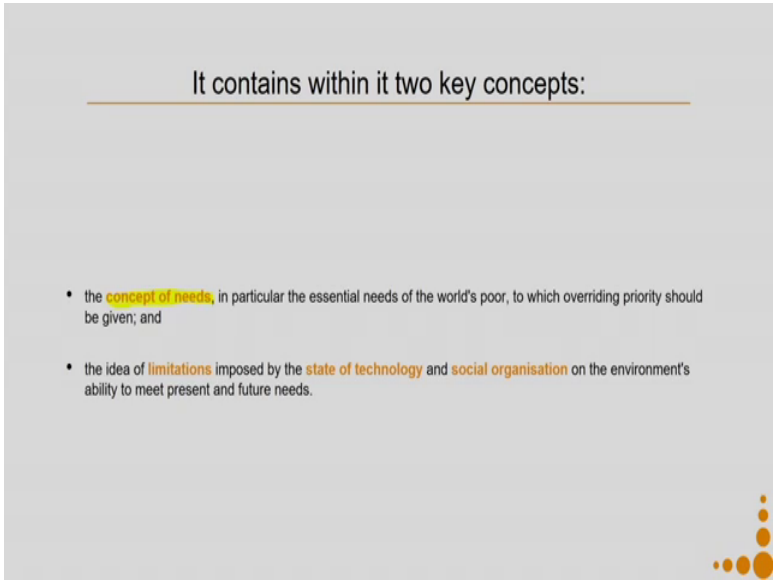

The first very important key concept is the idea of the concept of needs. So, we are not talking about the needs of say the rich or sometimes we confused between what is our need and what is our want. I may want to own a very expensive watch, I might want to own 100 watches and I might think that that is my need because with every garment that I wear I have to match my watch to go with it, to my watch has to be as per the current fashion trends.

So, I might feel that that is my need, but actually that is not a need that is a want. Hence, in this concept of sustainable development it has been clearly defined that the concept of needs in particular the essential needs of the world's poor, to which overriding priority should be given. Then comes the idea of limitations imposed by the state of technology and social organisation on the environments ability to meet present and future needs.

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What we meant by that? So, as we had already discussed, so, we never knew that CNG vehicles can be polluting. So, we assume because there is no smoke coming out of it. So, there is this particular solution is not a polluting solution. But only when new information, new knowledge, new scientific studies happen in this context it was figured out that a CNG vehicle releases this carbon nano particles, which are carcinogenic. Hence, our idea of limitations imposed by state of technology because you might just not know at that point of time that something is harmful.

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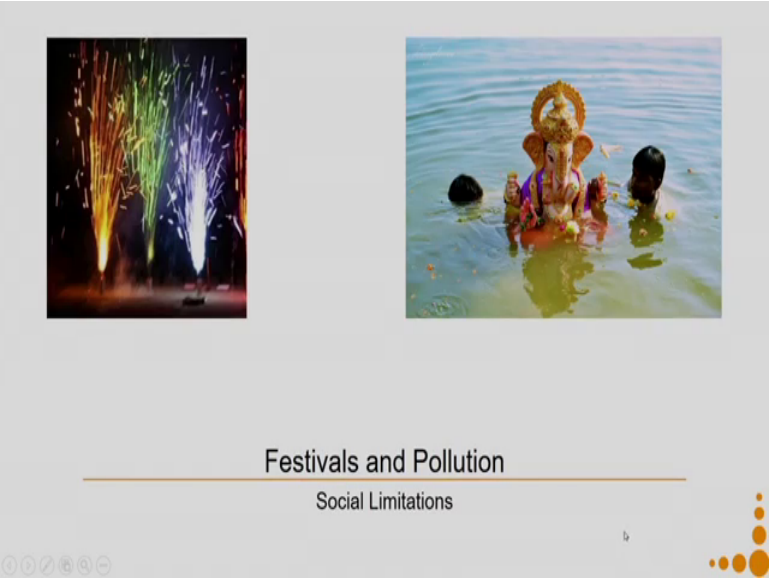

Then coming to social organisation, we discussed about say for example, different festivals have certain polluting effect. So, when we burn lot of crackers, it pollute the air. With smoke we also create lot of noise pollution. When we immerse certain idols in the which are made up of plaster of Paris on different kinds of plastics in a water bodies, we pollute the water bodies because these products do not degrade all of us know that by now and this is about the limitation imposed by social organisation.

So, when we are trying to do any kind of design, we have to take into consideration what are the technological limitations. We hardly have control over it because many a times it is just that we do not know that that is the limitation. And very importantly we have to look at the limitations imposed by social organisations and say how can we bring in improvement. Say for example, many states of our country there is huge campaign before festivals which says make your idols with clay and use those clay for growing pots or just even if you immerse that into a water body, it does not cause pollution. Do not use any colour on to it, if you are using colours then you use only organic colours and so on.

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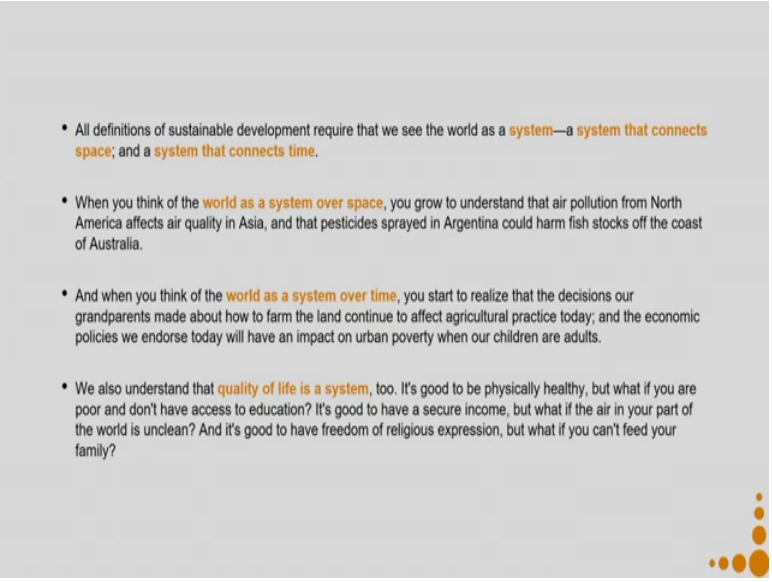

Also all definitions of sustainable development require that we see the world as a system, a system that connects space and that connects time. So, as we had discussed already space because if I create pollution over here, thousands of miles across the globe the pollution will travel. Why across time if I create pollution that is going to have an effect

on generations to come from now. And we have to also understand the concept of quality of life as a system. So, you if you have healthy, you are physically healthy, if you have access to education, but say if you do not have clean air the quality of life is low. So, we have to consider this in terms of quality of life as a system.

So, whenever we are looking at sustainability, in order to achieve sustainability because we know already that dimensions of sustainability are three and at the confluence is sustainability and you know of all the tools from design architecture and so on. They all were talking about whenever we have to consider all those dimensions. So, to make a good sustainable agricultural machinery you have to ensure that it does not damage the soil, it does not cause pollution, it is bringing in enough income for the person who is buying it, it is giving increasing the productivity of the fields.

What we are trying to talk about is to bring sustainability we cannot consider one aspect, we have to think in the whole system. As we have to also think what is the impact of this product now, what will be the impact of this product 20 years later, when the product is going to be no longer useful and it has to go to end of life. Hence, all sustainability has to consider systems design.

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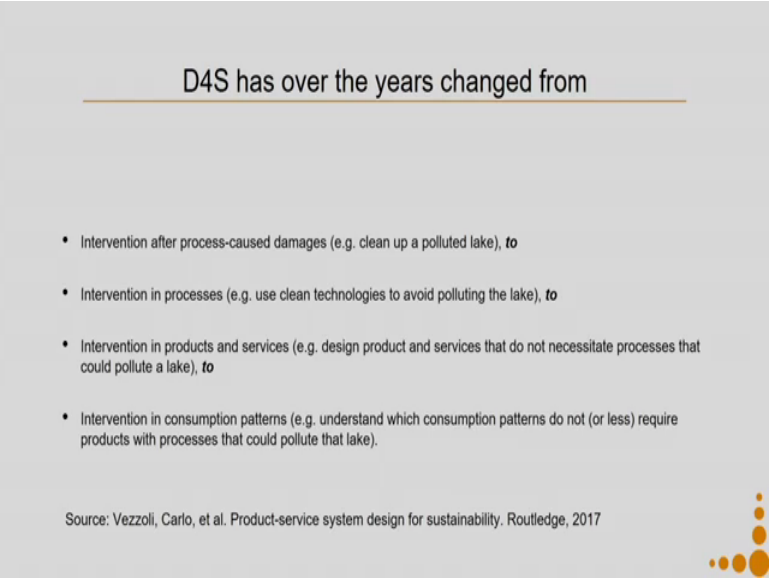

Next what we were discussing was about how design for sustainability D4S as some people call it has evolved over the years or has changed over the years. So, initially when people realise that ok, we have made up my lakes very dirty, the concept was clean up

the polluted lake. So, intervention after process cause damages, this although the focus has changed, but still say we have many polluted lakes. So, it is not that this is an abundant strategy already or abandon approach, this approach is still has to be taken to all those for all those lakes and all those damaging effects which we have done to undo those damages.

But now when we create new products new services this is not our main approach, we do not want to say lets pollute and then after pollution has been caused we will clean up. So, earlier when people just realise the bad effects their first aim was intervention after process cause damages. Then they realized ok, I have to do intervention in the process itself. So, I have to use cleaner technologies to avoid polluting the lake.

Next comes, intervention in products and services that is design products and services that do not necessitate processes that could pollute a lake. So, you design the product and services in a manner that you just do not need the lake at anymore. Finally, intervention in consumption patterns; example understand which consumption patterns do not or less require products with processes that could pollute that lake.

So, in our current design contexts you should always try to see if you can achieve this particular aspect that is intervention in the consumption pattern itself. So, that you can create processes and products which cannot pollute the lake.

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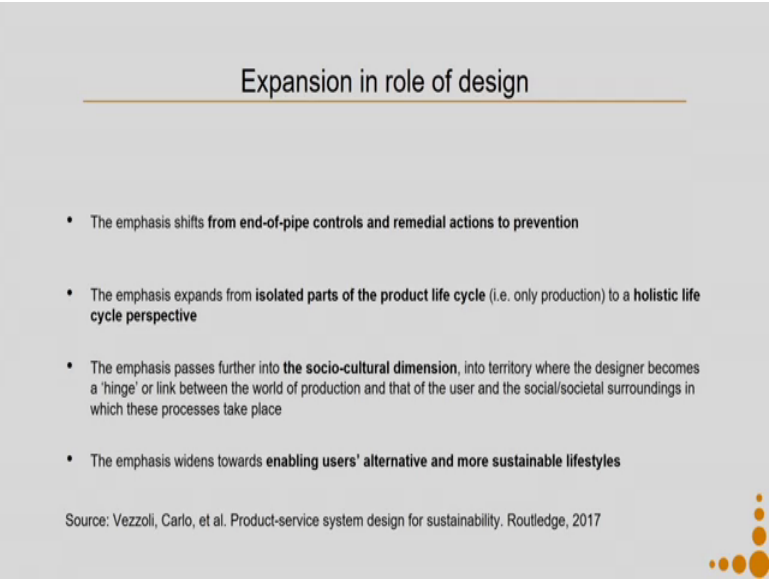

So, thereafter we were as a result of this we know that there is an expansion in the role of design. So, the emphasis now shifts from end of pipe controls and remedial actions to prevention. The emphasis expanded from isolated parts of the product life cycle that is production only or say for example, reducing energy consumption at the usage phase.

To a holistic life cycle perspective, the emphasis passes further into the socio cultural dimension into territory where the designer becomes a hinge or link between the world of production and that of the user and the social or societal surroundings in which these processes take place. Because you already discussed, it is about the social organisation which also determines consumption which also determines the definitions of needs which can have polluting effects which can have un-sustainability effects and these sustainability is not necessarily are on the environmental dimension, they are on the economic as well as the social dimension.

Then the emphasis widens towards enabling users alternative and more sustainable lifestyles. So, when you can educate people, educate users also enable them to adopt these alternate lifestyles which are more sustainable then you can bring in good degree of sustainability across all the three dimensions.

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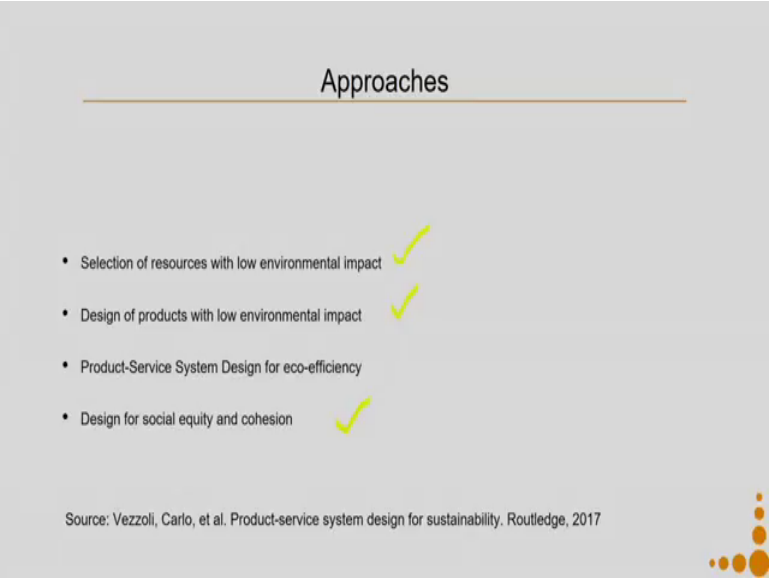

Our next concern was to discuss about the approaches that we can take, the design approaches that we can take to achieve sustainability. So, we discussed about four approaches; selection of resources with low environmental impact, design of products

with low environmental impact, product service system design for eco efficiency, design for social equity and cohesion. All these approaches can be taken up.

The approach, the first approach gives you more of environmental sustainability, when we are talking of design of products with low environmental impact we are again talking about the environmental dimension. As soon as we come to product service system design for eco efficiency, we are talking about the confluence of all the three dimensions; social, economic and environmental.

Try to recall the MSDS methodology and you can see that we in the SDO toolkit, we had all the three dimension social, economic and environmental. The design for social equity and cohesion in this particular context, the stress on the social dimension is extremely high, but one has to also bring in the economic and the environmental dimension together to achieve overall sustainability.

If we consider the difficulty level, so, when we are at step one at approach 1 and approach 2, approach 1 and approach 2 can be achieved through a life cycle assessment tools. It is a more straight forward aspect. Why because we are talking in terms of technological innovation which helps in reduction of environmental aspects. Of course, developing those new technologies is quite a challenge many a times, but the difficulty level at this the third approach increases because we are trying to talk about all the three dimensions and as soon as we are trying to talk about the social dimensions, the number of uncertainties increase. The same a social sustainability input does not have the same impact on different societies or under different contexts or under different time zones.

Also it demands from the designer, lot of different skills, a multidisciplinary skill. It also demands a huge team with multi disciplinary skills to bring in product service system design for eco efficiency. Similarly, the fourth approach is extremely tough because this whole approach starts with social as it is main focus and again anything doing at the social level is extremely difficult it is uncertain and so on. Also the other added difficulties is that the time frame for design for social equity and cohesion is extremely long, you do not see the changes coming in so easily.

So, if you try to recall the example of say Amul or say Varnapura that we had discussed, they are all examples of design for social equity and cohesion. So, they try to achieve sustainability with social dimension as the main focus and then trying to bring in

environmental and economic sustainability along with it. And you can see that they those initiatives have taken decades to take the shape that they have taken right now and they are still evolving and they have to keep on involving to stay sustainable.

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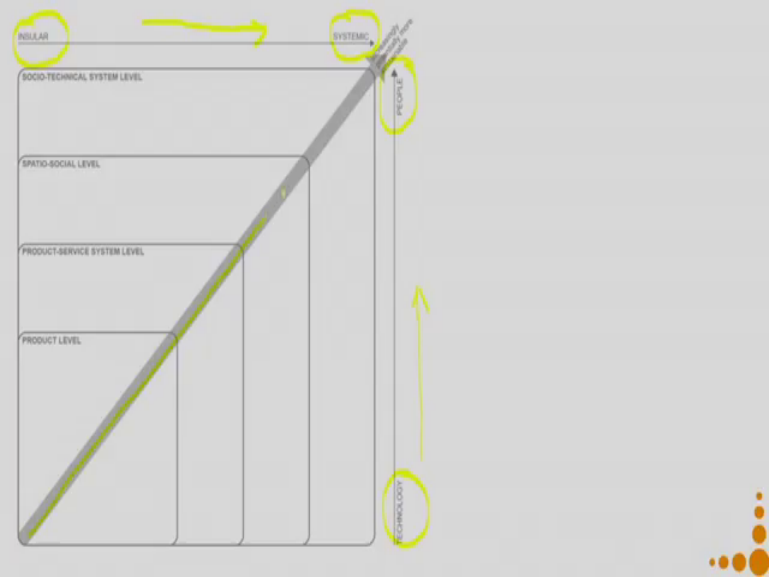

Thereafter we went into discussing how we can put all these different approaches in terms of in a 2 by 2 graphs. So, I have insular which is like is one component and I have systemic which like involves the whole system oriented. So, on this access my level of systemic it becomes more and more system oriented. Here, I have concepts which are more technology oriented and here which are more people oriented. So, as we move towards the top, we become more and more people oriented. It has been observed that we when we are moving toward through this line, the potential for sustainability increases.

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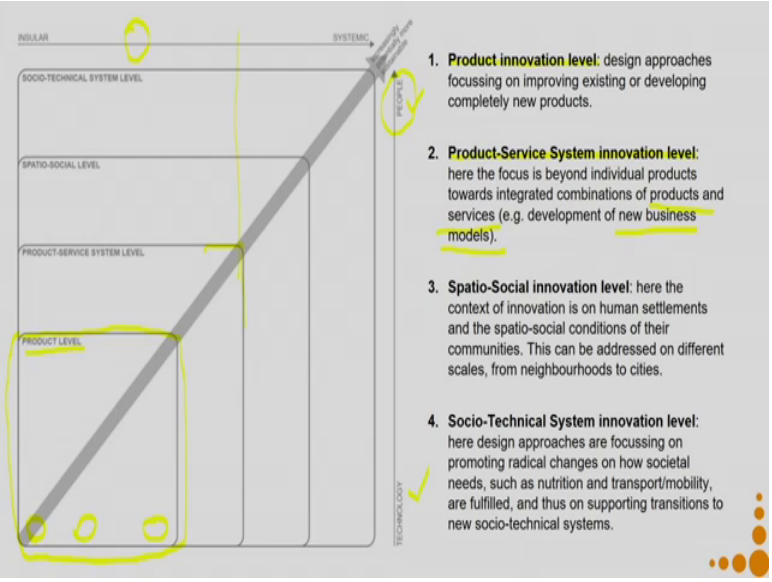

So, at the product level, I can have my interventions; sustainability interventions. At the product level, product innovation level design approaches focusing on improving existing or developing completely new products which are more technologically advanced and as a result they are more environment friendly.

So, as you can see all though the I have certain levels over here where so, if I am over here, my technology component is the soul intervention level and it is very insular in nature. If I move more towards this, so, I am still focusing on technology, but I am getting more systemic because I might be in get involving many other partners to bring in that technological innovation. So, at the product level you can see that the degree of technology involved is they much higher, the concern for people is the social aspect of it is lower the socio economic aspect is lower and also these concepts are more insular.

At the product service system innovation level, here the focus is beyond individual products towards integrated combination of product and services that is new business model. As soon as we get into this model, our increase in the people dimension is visible. So, you can see I have more people because I have to involve lot more entities, since I am talking about business models and integrated products and services. So, I am getting more and more systemic.

Then we discussed about the third level. So, in our entire course we discussed about tools and methods which can help you to achieve product innovation level, which was about

the LCA related tools and the product service system innovation level which was to do with the MSDS methodology.

In after you have design something using the MSDS methodology, it is always advisable that you also do a life cycle assessment of that my new design. Then comes the third and the fourth level which we did not discuss tools about because they beyond the scope of the projects, so, of the course. So, spatio social innovation level; here the context of innovation is an human settlements. So, in spatio social innovation level, we are mostly talking about social innovations and the social innovations are related to the community, the space that they are related. So, one particular spatio social innovation may or may not be replicable to another location.

Because the spatial and the social conditions vary wherever the spatial and social conditions are similar, you can replicate them. Say for example, you bring in a solution for water conservation for community which lives close to source of water say river will be very different as compared to a solution that you are trying to a human settlement related solution that you are trying to bring in for a region where which is the desert or say which is located in the high altitude in the mountainous region. So, this can be addressed on different scales from neighbourhoods to cities. So, they can be as small as just considering the neighbourhood or as large as considering cities and districts and so on.

Again when we are talking about the spatial social level because the involvement of people level is very very high, as a result it becomes more and more systemic. At the socio technical level what we are concerned about is approaches focusing on promoting radical changes on how societal need such as nutrition and transportation or mobility are fulfilled and thus on supporting transition to new socio technical systems.

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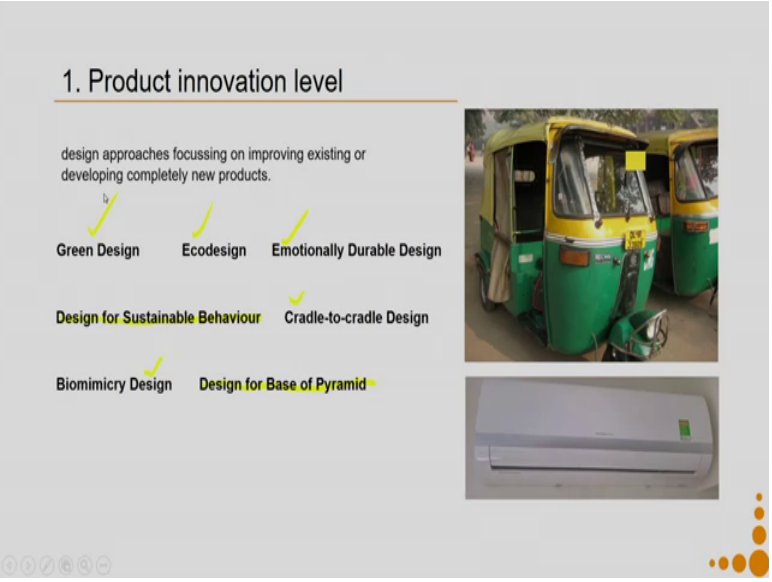

So, some of the approaches that we discussed in the product innovation level they were about green design, eco design, emotionally durable design, design for sustainable behaviour, cradle to cradle design, biomimicry design and design for base of the pyramid.

So, when you look at design for sustainable behaviour, it was one particular concept in which we were touching upon the people dimensions slightly in all other concepts. Even in the design for base of the pyramid we do touch upon aspects of the people, but in all other strategies we are only concerned about the technological mostly concerned only about the technological part of it.

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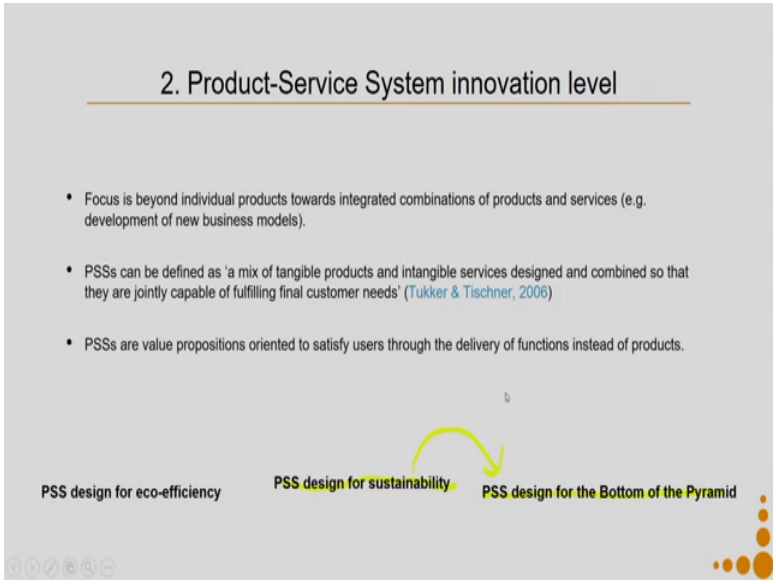

In product service system innovation level, we were talking about three approaches that is PSS design for eco efficiency in which not necessarily the social dimension be involved. The PSS design for eco efficiency says that you design a offer model in a product service offer model in which for the providers the people who are providing the product service system design to it is customers.

It is in the economic interest of the stakeholders to be environmentally sustainable. Whereas, when we talk about the PSS design for sustainability, we get into we add the social dimension to it. So, what over here we mean that create an offer model consisting of products and services wherein, for the providers of the products and services beings economically and socially sustainable is sorry being environmentally and socially sustainable is in the economic interest of the providers. Then comes PSS design for base of the pyramid. So, it is the same concept when applied to base of the pyramid.

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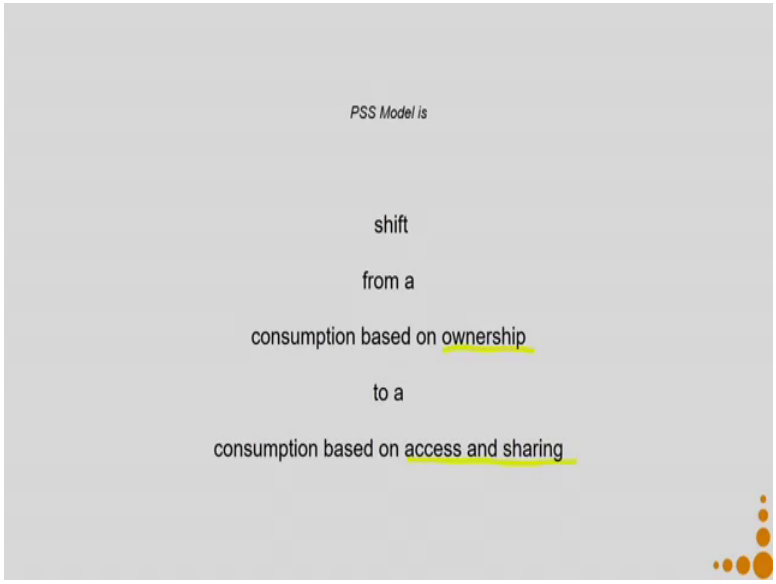

So, in the PSS model we were trying to discuss how we shift from a consumption based on ownership to a consumption based on access and sharing. When we start talking about access and sharing then only the service model comes. So, I really do not need to own the products. I really do not need to own the washing machine. So, if you recall the MSDS methodology, we had a ideation part in the SDO toolkit.

So, we did ideation on system design, we did ideation on service design and the aim of both the ideation was how can I bring in social, economic and environmental sustainability by system level intervention and service level intervention. By doing those intervention, I shift my consumption from ownership to consumption based on access and sharing and make this whole model economically great for the providers as well as the consumers. So, in that context again we were discussing about our unit of satisfaction.

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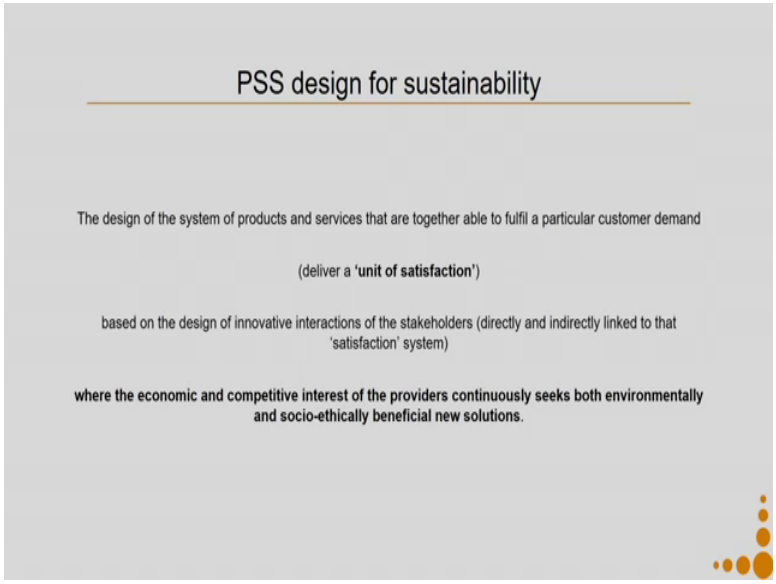

So, PSS is design for sustainability, the design of the system of products and services that are together able to fulfil a particular customer demand that is delivery unit of satisfaction based on the design of innovative interactions of the stakeholders, directly and indirectly linked to that satisfaction system, where the economic and comparative interest of the providers continuously seeks both environmentally and socio ethically beneficial new solutions.

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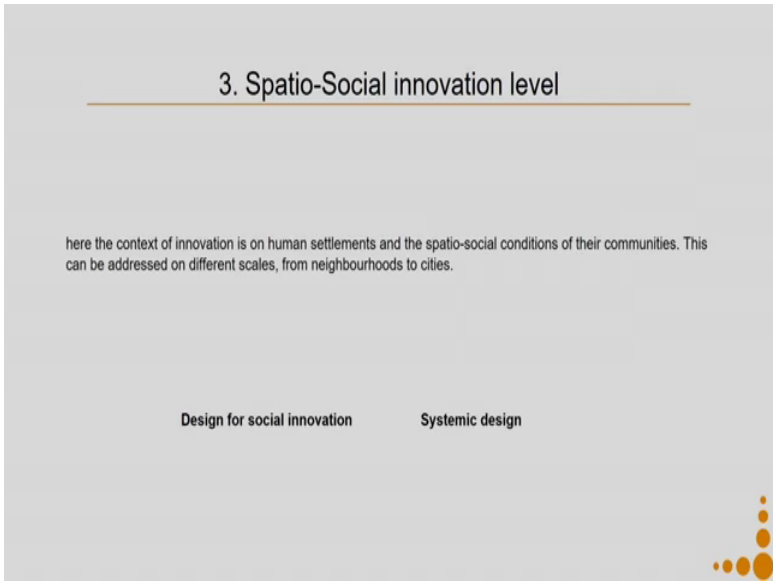

At the spatio social level we looked at design for social innovation where the main concern was social innovation. It was not concerned with technological innovation. So, using existing technology and maybe not using any technology, if that is not a requirement, the aim was social innovation. Then systemic design wherein we try to bring in system oriented innovation by using the concept of bio mimicry.

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The socio technical system we already discussed.

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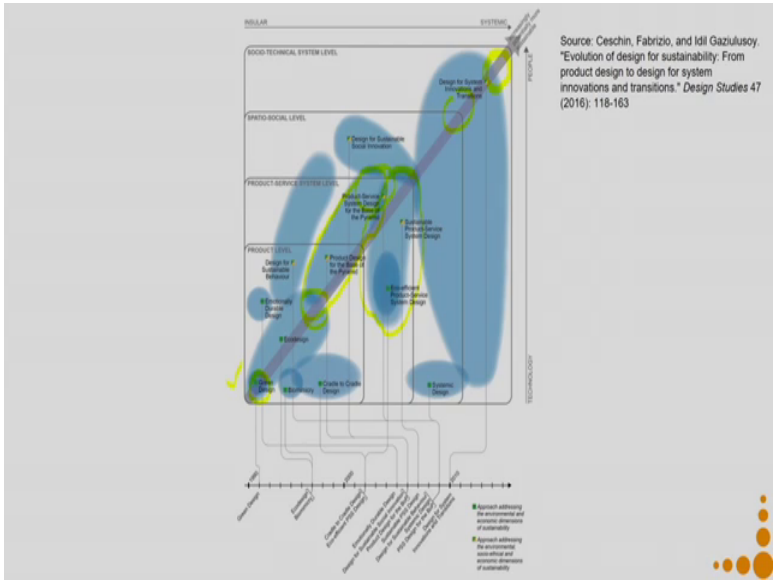

So, then we try to plot all these onto this graph to see which of these methods cover which aspect of be in solar systematic technology of people. So, you can see green design only talks about technology, whereas the product service system design for base of pyramid at transgressors the three levels. So, although when we are talking about product service system design for base of pyramid, we took it up in the product service system level because that is the major aspect of it, but this particular domain also transgresses that can be also a product level, it can also be at the spatio social level.

When we talk about sustainable product service system design, we are somewhere located over here. So, always we need to try to reach as far as a over here because as that is the most sustainable domain where we can reach.

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So, from all this discussions what we concluded was the concept of sustainability is not a static goal. So, here you can see, so, none of these concepts that I said is. So, all these concepts has certain degree of sustainability protection. So, one say for example, for me if it is today very easy to approach green design, first I approach green design because it is very difficult for me to do something at this level.

But then nobody stops me to go to this level and go to this level and so on. So, the whole concept of sustainability is not at all a static goal. We reach a particular goal and when then we try to achieve higher goals. So, say for example, initially you were having 3 star air conditioners, now we have 5 star air conditioners as slowly we might have even

higher star air conditioners. So, even at the green design perspective, people made progresses, step by step progresses. So, in the concept of sustainability is not at all a static goal, it is a moving goal.

So, when you are trying to do a design, you have to see how you can create a dynamic goal. So, for the next 5 years these are my resources this is the amount of time I have available. So, I will reach this level. In the next 5 years I will reach in a level 2 and so on. It is a dynamic and moving target responding to our ever increasing understanding of interdependencies between social and ecological systems. So, it is part 1, it is dynamic because at a given point of time we might not be able to achieve more than that because you do not have the time resource, the money resource the human resource.

The other aspect can be because we still do not know about the interdependencies of the social and ecological systems. So, as we come to know more and more about it, we will further move our goal for sustainability. Sustainability is a system property and not a property of individual elements of the systems. So, a pencil in itself is not sustainable, because that just an individual element. So, only when you take up the whole system then it is sustainable. So, therefore, to achieve for achieving sustainability you require a process based, multi scale and systemic approach to plan for the sustainability guided by a target or vision.

And as a result it is very important to use the tools that I discussed in this particular lecture. If you do not use the tools, the problem is that you might lose on to many of those aspects involved. Yes, once you get very pro you have used those tools for many many times maybe you will not miss on to those aspects, but in the beginning you will surely miss on to a large chunk of this. So, it is very important that you are use the tools that has been discussed and try to achieve this multi scale systemic level sustainability.

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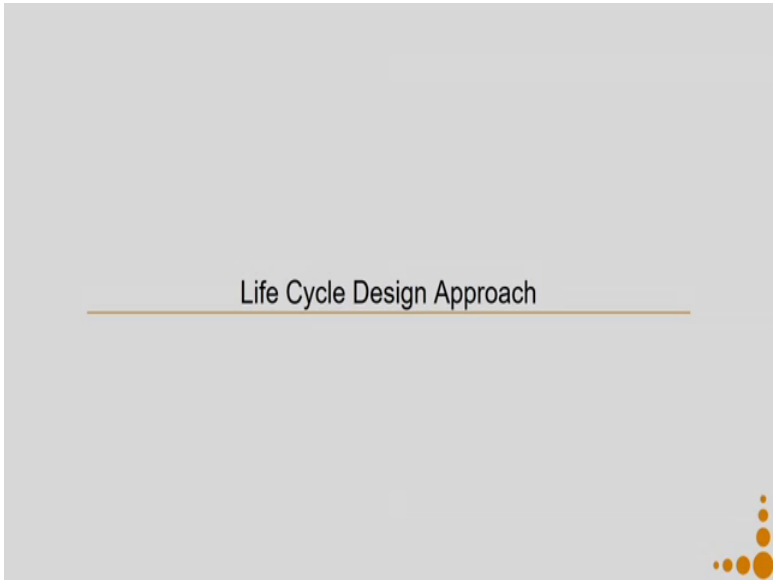

Then we went into life cycle design approach. So, where we can actually in terms of numbers compared to solutions; whether carrying fruits and vegetables in carton is better or carrying it in a plastic crate is better. So, in terms of numbers we can actually quantify. The context we discussed was very very important.

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So, whether are we taking a products from Delhi to Jaipur or are we taking the products from Delhi to Guwahati or is it in a all together different country.

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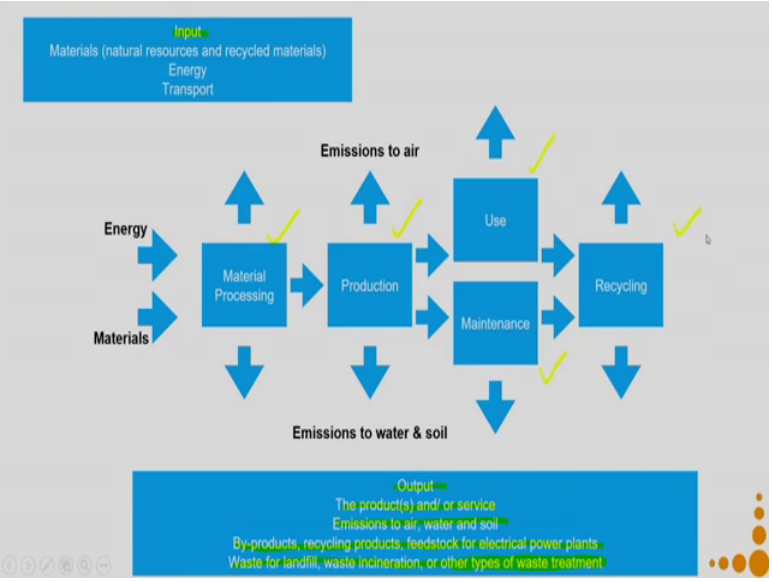

So, why that was important? Because in order to do LCA, we have to consider all the inputs that is materials, natural resources, recycle materials, energy and transport and we have to also consider the output; the product and the service, emissions to air, water and soil; all kinds of by-product recycling products feedstock for electrical power plants. Waste for landfill, waste incineration or other types of waste treatment. Now, all these are very contextual.

So, the amount of energy that I would need to spend to travel from Delhi to Jaipur is very different from Delhi to Guwahati or from Delhi to Hong Kong. Hence, the differences also say for example, when we are talking about other types of waste treatment, different locations might have different types of waste treatment possibilities. As has the context in this case is the for doing this life cycle assessment is very important and as a result of the context at times you might find the paper crate is a more sustainable solution, at other times you might also find that the plastic crate is the more sustainable solutions.

Hence, one should not go by the by intuitive approach that yes plastics are always bad. So, plastic has to be modern sustainable. So, that was the main aim for discussing life cycle assessment that one has to always do a life cycle assessment and take a judicious decisions on which one is a more environmentally friendly solution or process or product for a given context.

So, in this case we spoke about all the inputs, all related to material processing in the production phase in the use phase maintenance and recycling all the emissions to air water and soil. And then we also discuss how to calculate them using software's.

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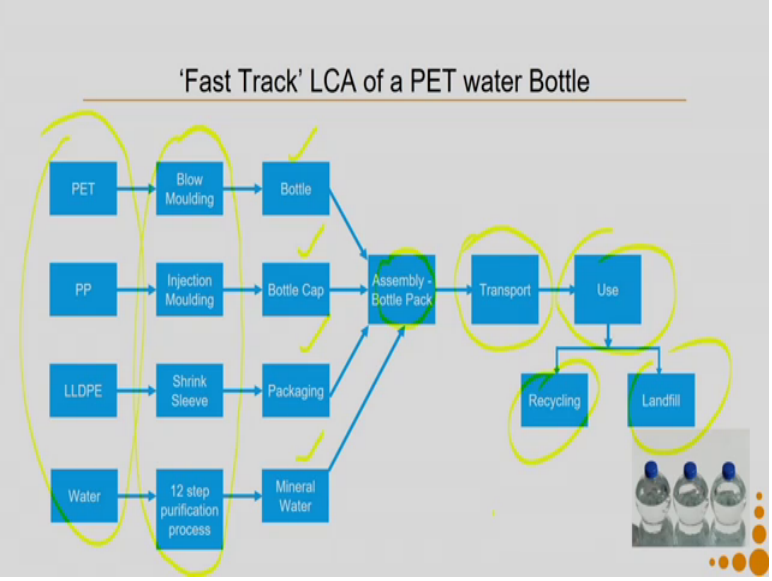

So, we discuss ok, if this is an assembly of bottle of pack what are the sub products involves? So, assembly of bottle pack consists of the bottle, bottle cap packaging and mineral water, what are the processes from manufacturing them, what are the raw materials and then it goes to transport use recycling and landfill. So, we learnt how to do the calculation.

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Next we went into designing tools for; next we went into see how to design for sustainable product service system design.

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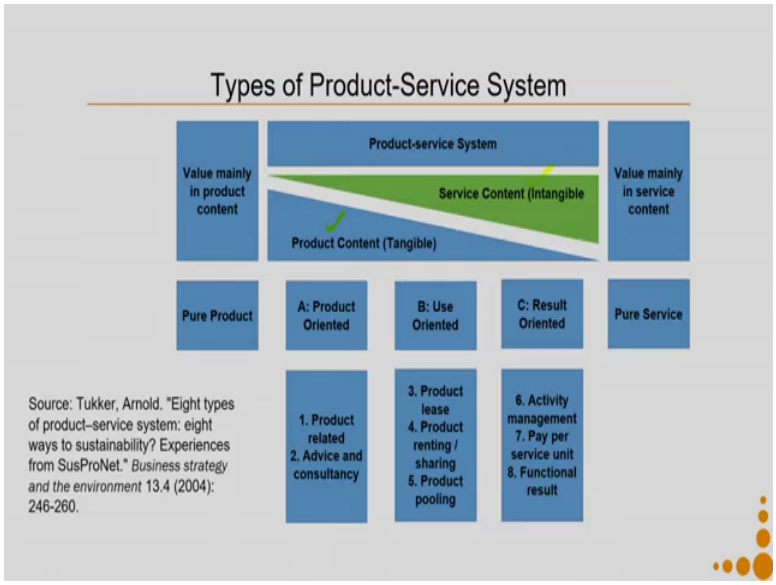

So, in this category first we were into trying to understand what types of product service systems can be. So, there can be different degree of product content and service content involved. Something can be sum the 2 extremes, value mainly in product content where the whole thing is only purely product. So, when I sell a pen, I am just selling the pen

and I am not responsible for anything after selling that pen; me as a manufacture. Then what I am offering is a pure product. So, the value mainly is in the product content.

There is another extreme where the value mainly is in the service content. Say for example, insurance which is a pure service. There is no hard tangible product involved. But our product service system is somewhere in between them. So, to meet most of our day to day requirements, we actually need some kind of a product. So, even to project this lecture, you need some kind of a tool; you need a mobile device, so, you need a computer or you need a projector and so on.

So, we are in this category where there is some amount of product and some amount of service involved. There can be a product oriented PSS, where which is related to a product or advise and consultancies. Say I give a I buy washing machine, I also get installation services, I also get maintenance services. Me as a customer, I pay to the company for those services. There is use oriented PSS, like in this case in the product oriented the customer still owns the product. Hence, a sustainability potential is lower because I me as a consumer I will own that product, but I will not be using it to the most optimal.

Also the manufacturer knows that I am not liable for the product anymore. Even if it breaks down, the customer has paid me to repair those breakdowns. Hence, it is less in the providers interest to seek more environmentally friendly solutions. Whereas, in the use oriented and the result oriented because the product ownership remains with the provider itself and the customer only pays on the basis of the amount of a it consume the amount of the satisfaction unit consume.

So, it is always more in the interest of the provider to bill in sustainability in terms of efficiencies, in terms of long life of the product, in times of repairing it or servicing it at regular interval. So, that it has made maintenance efficiency and long life and so on. So, in use oriented, you lease a product, you rent a product, you share a product or you do product pooling, but the highest sustainability potential is in result oriented in PSS.

Because it is on paper service unit and it is just not the botheration on the customer how you provide the service which gives the provider a big possibility for making themselves as sustainable as possible or as energy efficient as possible. But be aware that one has to build in those sustainabilities, it does not.

So, say for example, a catering service if I hire a catering service that is a result oriented PSS, but not necessarily that is sustainable because aspects of sustainability has not been built into it. So, the caterer might give you food in plastic disposable plates because that is convenient for the caterer resulting in huge amount of wastages and environmental problems as a result of it.

So, none of the product service; so, designing a product service system does not ensure sustainability. One has to design a product service system using the MSDS methodology to try to bring in social, economic and environmental sustainability. And at the same time keep in mind that we are not talking about sustainability through charity. We are talking about sustainability through PSS, in which it is in the economic interest and competitive interest of the providers to be sustainable.

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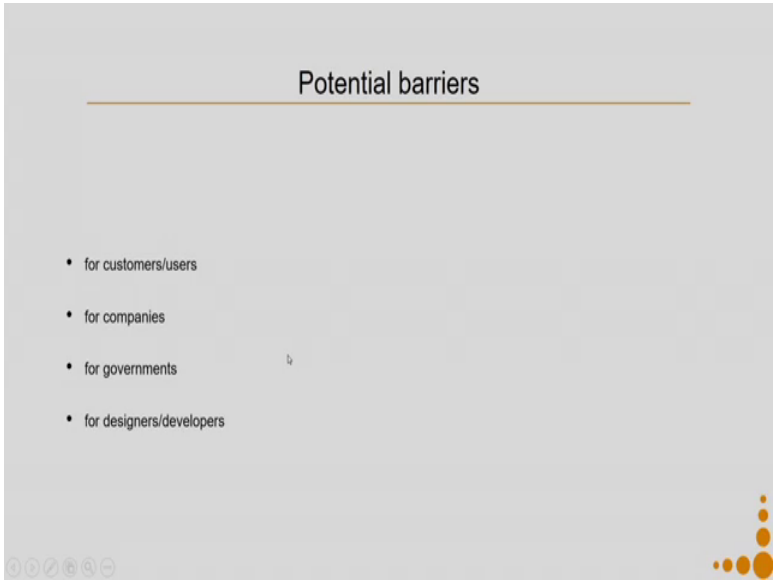

We also discussed about potential barriers to this SPSS approach which comes from customers or users, companies, governments, designers and developers and how do we cater to them.

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So, say for example, from consumers, it might be just how the consumer wants to consume because of social norms because of institutional settings or the whole industrial revolution which is how the companies operate.

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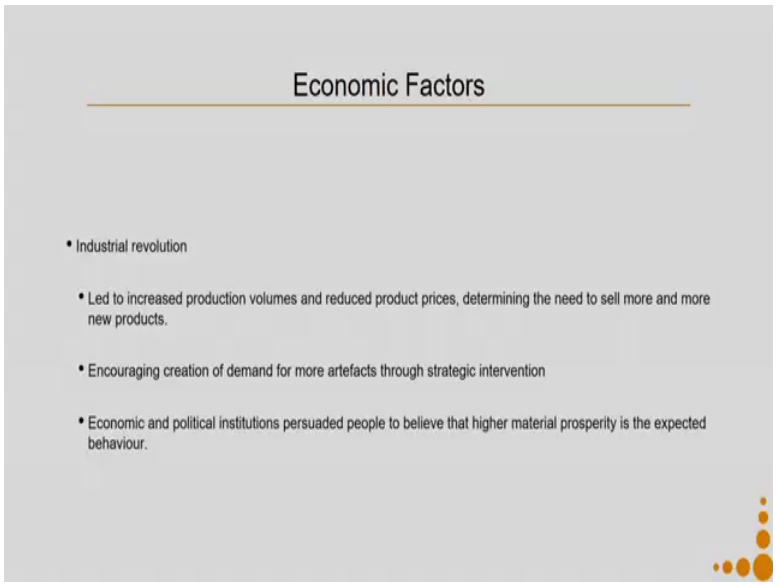

They want to maximize their profits, they want to increase their production volume, as a result they need to sell more. So, they have to make people buy more that is how the current way of looking at the whole economic structure is.

So, we need to bring in changes that ok, you can make money not only by selling more products, but you can make money also by selling less products and replace it with services bring in higher sustainability. So, we discuss examples like Kluber, lubricants which has try to achieve the same thing through it is service.

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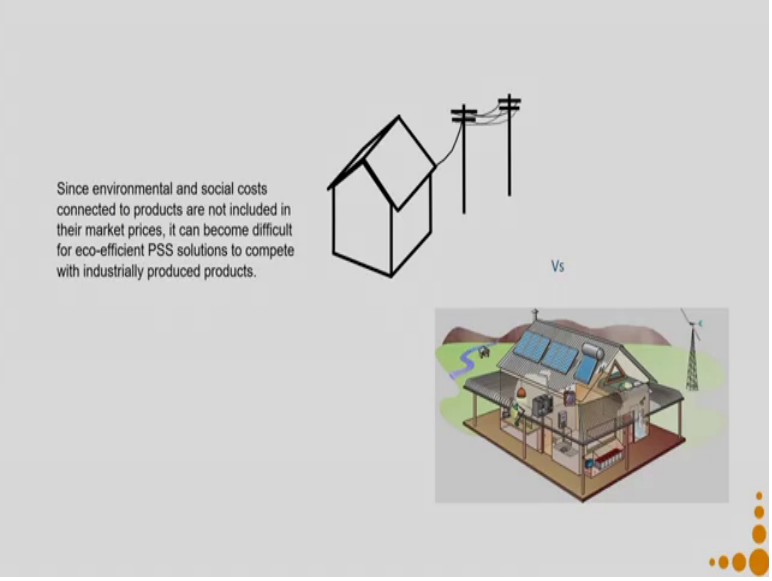

Also we have to consider that currently the social and economic degradation or the; so, environment sorry environment and the social degradation cause are not included in our main industrially manufactured products.

So, when I am taking electricity from the grid, I am not I am paying only for the electricity, I am not paying for the damaging effects caused by say thermal power production. Whereas, when I have to own the solar power panels and the batteries and all that in my house if I follow the same model, then I am in trouble because then my product cost very much high the initial cost is very much higher. So, as a result these renewable energy products are not able to succeed so much in the market.

Because in the conventional power the I am paying very much lesser because the social and the environmental costs are not included into it. So, I have to device either ways in which I can bring in those cost into the consumers mind or I build in innovative business models in which the customer does not have to on those solar power panels.

That is what how we have been discussing in the SPSS model. So, if you remember the example from the company empower which does the same things. So, they own the solar power, the solar power generating panel, they also own the bulbs, the fixtures and the charges.

And the person who subscribes to that service pays per unit of energy consumed. As a result the energy consumption reduces.

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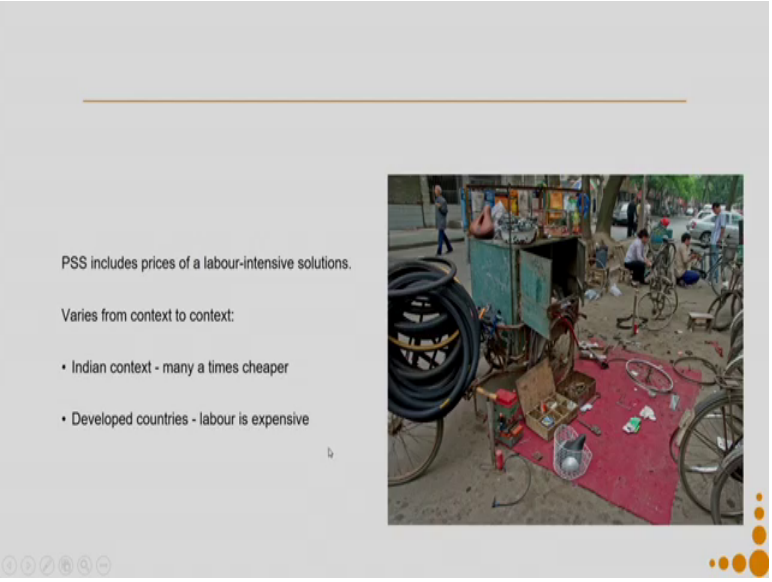

Also another concern was PSS is labour intensive be providing service is labour intensive. This might be a good solution in certain contexts like in developing countries like India, where labour is very much cheaper. So, it might be economically viable solution, but in other developed countries where usually labour is very expensive, providing a PSS might become very expensive affair.

So, while you are trying to design your PSS, you have to also consider this aspect that how the service element is brought to the customer so that it also takes care of the cost involved due to the labour involved in it.

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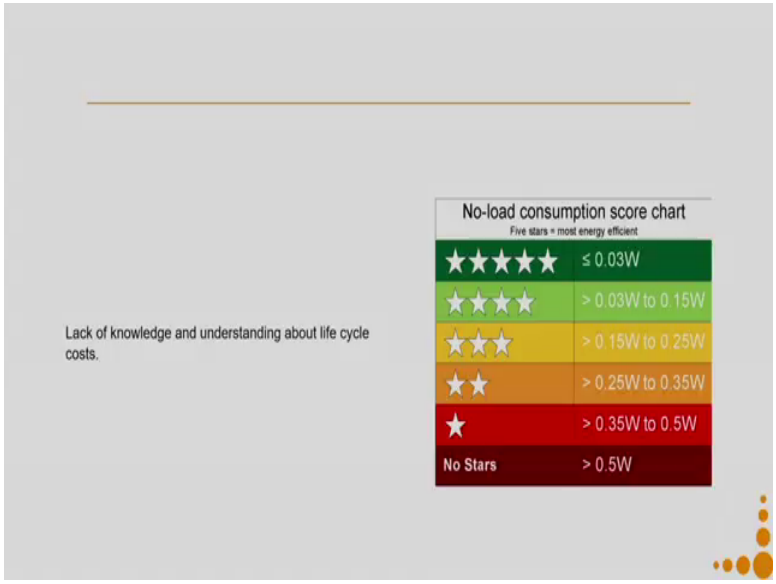

There is also lack of knowledge and understanding about lifecycle costs. So, that awareness needs to be created among customers by company, by NGOs, by the government, so that people shift to products which are more energy efficient or say more water efficient.

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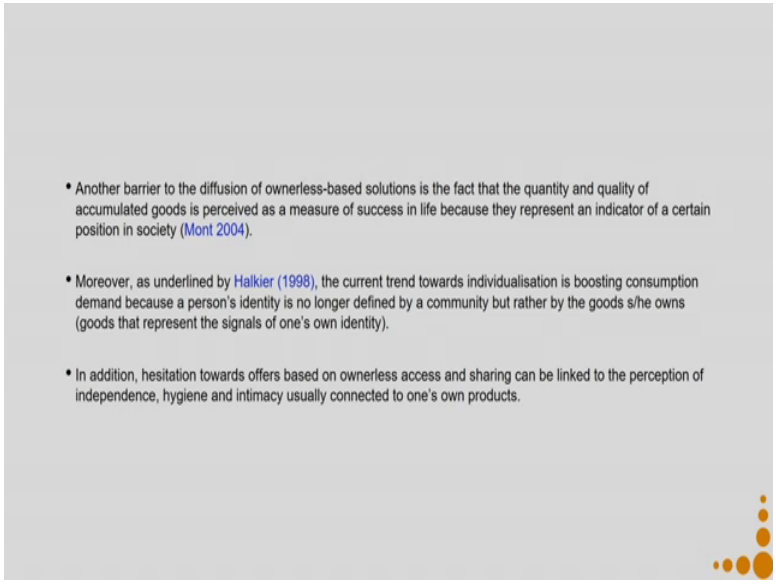

There were some other barriers like how do we diffuse ownerless based solutions in a society where ownership is linked to prosperity or say there was a huge trend towards individualization. So, you own products which is individualized to use it effects your

personality. So, customisation was done. Now, we are talking about shift back to products owned by community. Then how do we build in this aspect of individualization in these particular context? There are also hesitation towards offer based ownerless access and sharing due to reasons like perception of independence.

Can I use the product whenever I want to? Maybe not or hygiene and intimacy usually connected to one's own products, you may feel this washing machine is always with me I am sure about it is degree of hygiene and intimacy. Whereas, if I use public washing machine, I just do not know what somebody washed before me, how dirty that person might be and so on. Then we went into how to bring this transitions to SPSS, mostly by system aesthetics. So, we will be using the MSDS mythology.

But the MSDS mythology actually is not talking about how to bring in system just say this is where you as a designer come into play that how do I build aesthetics into my system. So, we took this example of LG bar. So, this is a community washing machine plus a bar. So, in the evening you come to this bar you have drinks with your friends, you chat with your friends, you play some games and at the same time you are washing your clothes. So, that might make the solution a desirable solution and enjoyable solution.

So, it is just not only visual aesthetics, but because you are talking in terms of this system, a system has different kinds of (Refer Time: 54:22) like our example of the rag pickers. How they have been organised, they have been given good uniform, they have been trained on interpersonal skills. As a result the system aesthetics of waste collection door to door waste collection went high they become from rag pickers to professional waste collectors. They got into educating also people about segregation of waste and people did comply to segregation of waste as per their solutions. Then we can also this we have to also considered that how do we design (Refer Time: 55:07) do make sustainable PSS. But how should I customise my PSS depending on different contexts? So, an example was like Ola having boat services in certain places where river is one of the major source of transportation. Why not?

Then coming to the third way of achieving this transition was technological innovation complimented with social innovation and we saw how Amul had done both of the 2 things together. We also discussed that government has a very important role. So,

policies play an a very important role in achieving sustainability and sustainable PSS development.

The finance cycle were one of the most important thing many interesting PSS they either fail or they cannot take off if you have not considered how you can effectively finance your SPSS for your providers, for your customers. So, it is a very important tool. You as a designer you might not be scaled at doing all these steps. So, a very important aspect of SPSS is you make teams, you make good effective teams with people from different backgrounds. So, you take up the MSDS to you will know all those. So, let us come to SPSS barriers for designers. So, knowledge and skill in the system design.

So, when you know what are the system components that is you know while we are using the MSDS method, the various steps which you are require your first step becomes identifying all those experts all those people who have knowledge and skill in all the different components of it and you as a designer you have to develop your knowledge and skill in system design and systems thinking how can you bring all of them together and design a particular solution. So, for this you have to develop some of these key competences. Systems thinking, interdisciplinary work, never try to achieve you can never achieve sustainable product service system design.

If you try to design from your own disciplinary or just from one discipline background you have to get into interdisciplinary work. The more interdisciplinary work you can achieve the better is your system design. It also brings in a lot of problem because different disciplines that talk in different languages, they have different ways of approaching a problem. So, it takes certain amount of time and practice to get used to how to work in interdisciplinary teams.

Then you have to do critical thinking and analysis of each and every aspect question, why, how, where? Then you have to do anticipatory thinking ok, if activity a or if product or your service a or if process a is used, what will be the impact in next 5 years, in next 10 years, what might be the impact of the government policy changes after 2 years. So, all kind of anticipatory thinking has to come in. So, you have to develop more of that skill. You have to develop interpersonal relations and the ability to collaborate with interdisciplinary teams, many a times it also happens that you are doing fire fighting

because your team members are fighting with each other. It is just because they have different ways to look at the same thing.

So, you have a through practice you learn how to bring in collaboration. Then empathy and change of perspective; you have to feel for the people whom you are designing for and you have to be always ready for change of perspective. You have to look at a particular problem from as many perspectives as possible. Then you have to take strategic action because we are talking about business models, so, which is all about strategic action.

You have to have tolerance for ambiguity and uncertainty. So, when you are doing this kind of a system designers, it is full of ambiguity and uncertainty you really do not know what you are going to end up with. A huge amount of personal involvement is required, you have to keep on doing assessment and evaluation at every stage and phase and make change of course as per requirement. You have to be proficient with use of communication and use of different types of media and very important think of what in a given context is about justice your responsibility and ethics.

And try to understand from all stake holders involved what is justice, what is responsibility, what is ethics in the given context. When you are trying to look at an SPSS, you have to also look at the cultural perspectives because they are very important to which determines actually something will be acceptable or not, how soon it will be accepted and there are many existing cultural practices that is a benefit of our way of living because our way of living has evolved over thousands of years. So, there are many cultural practices which actually have very inherent sustainability capacity or in a capability. So, you have to also be very careful to observe them and to take them forward in your design.

You have to also be careful not all culturally propagated or culturally ingrained practices are sustainable. So, you have to be very very careful identify the ones which are sustainable, ones that are not and use them appropriately in your design. You have to also consider the psychosocial factors; like, consumption choices are dependent on prior consumption patterns. So, you have to identify the prior consumption patterns and then make appropriate design changes. You can bring in a radical design chain, but then you have appropriate promotional activities. So, that people adopt that radical change.

So, in the next part of the lecture we will pick up the tools that we had discussed and we will try to summarise them, we will build the connections we will see how, what are the similarities, what are the dissimilarities and how we can relate those tools and the sustainability.

Thank you so much.