System Design for Sustainability
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Lecture – 38
Design for Sustainability – Concluding Lecture

Hello everyone, welcome to the next part of the concluding lecture. Now, we will talk about all the tools and methods that we have discussed and try to see the interconnection between them the similarities and dissimilarities and try to reason out for the same. So, let us start with our methodology the MSDS methodology on which we spend a considerable amount of time.

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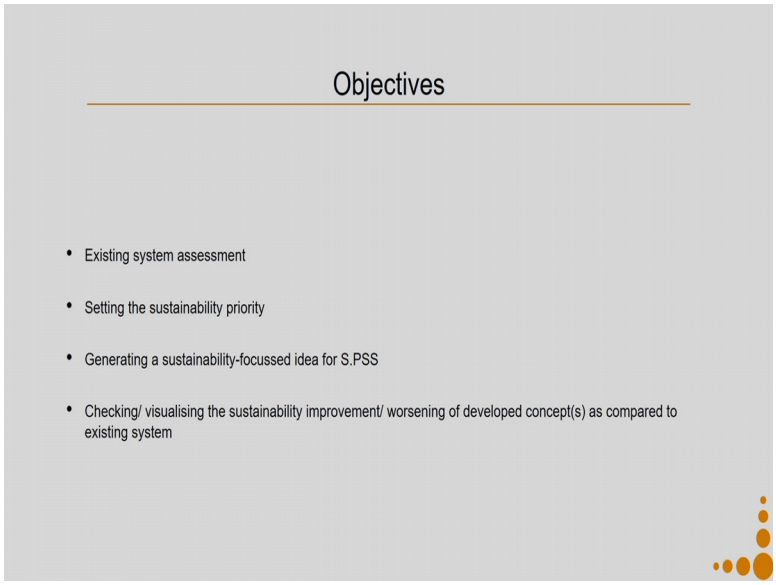

So, this particular methodology, the objects objectives of it is to analyze the existing system and do an assessment. Then set the sustainability priority in the context of the above analysis, then generate a sustainability focused idea for SPSS and checking or visualizing the sustainability improvement or worsening of developed concept as compared to the existing system.

So, this particular methodology helps us to design sustainable product service systems. It also is a modular in a way of designing for system design for sustainability, where all we can we use this particular methodology. This methodology has a very wide implication, but the methodology has been designed specifically keeping in mind that we want to

design for say products for company's products for NGOs, products for product service systems for NGOs company's government organizations and any such organizations.

So, this particular tool is helpful when you are want to do an SPSS in the context, when your PSS is product oriented PSS result oriented PSS or so, let us come to the stages of this particular MSDS methodology.

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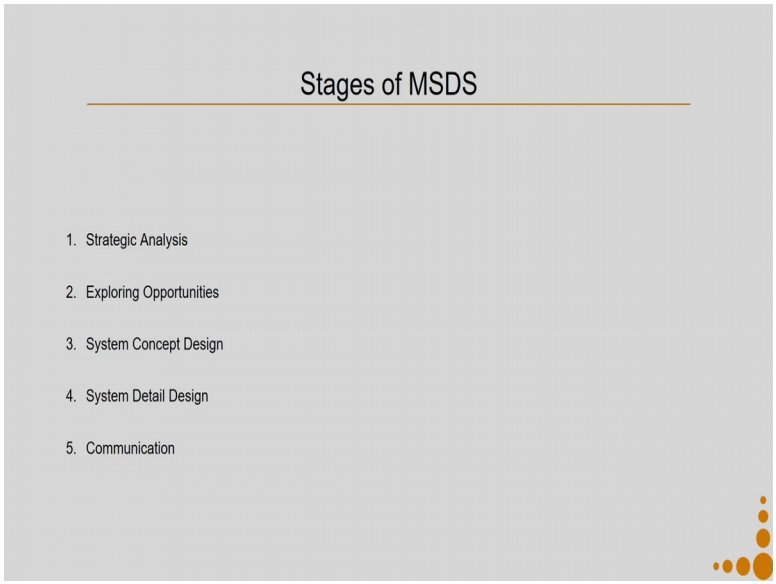

So, the stages involved strategic analysis where we try to understand the existing scenario, come up with what should be the design intervention context then we get into exploring new opportunities. So, these opportunities are nothing, but ideas and cluster of ideas, these ideas are supposed to be system oriented ideas or service oriented ideas which helped to achieve the sustainability target or achieve the design solutions which has been invasion in the first step that is a strategic analysis step.

Once we are done with exploring opportunities, we get into design of the system concepts how do we do that? We cluster some of the ideas, that we have generated in the exploration phase and we build them up into system concepts we might come up with more than one system concepts. Then we will do an assessment of all those system concepts in terms of sustainability, the degree of sustainability that they offer on all the three dimensions as well as their feasibility in terms of technology as well as the time frame or resources available.

Once we have selected one of the concepts, then we go ahead with system detail design. In the system detail design phase, we try to detail the whole system concept that we have developed in a manner that anybody who picks up my report now can implement my idea in practice. And finally, the step of our communication comes where we need to communicate with all stakeholders involved or other parties who might be interested in knowing about our project all the sustainability improvements that we have made how we have done it and so on.

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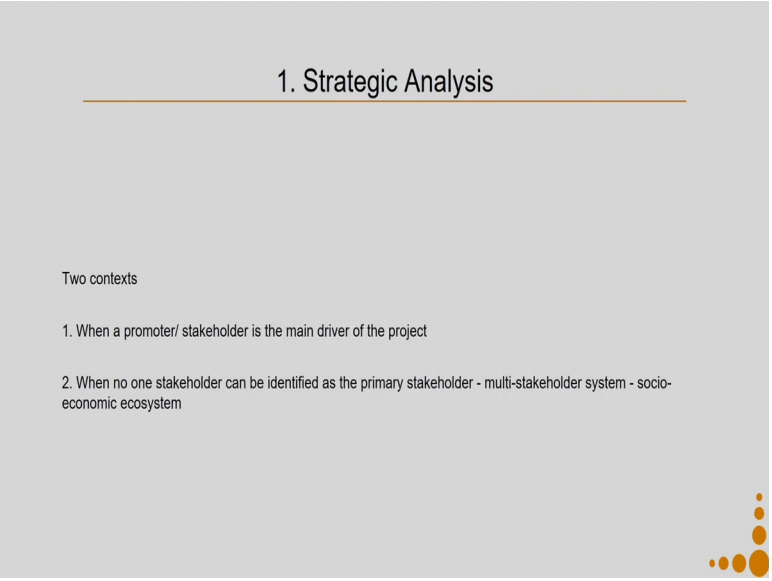

So, this particular methodology in the phase one strategic analysis, we can have two different kinds of context depending on the context we approach the strategic analysis little differently. In the first context when a promoter or stakeholder is the main driver of the project, that is there is one promoter or a couple of promoters or one stakeholder one main stakeholder or couple of stakeholder, who together are the main drivers of the project.

And most likely they know about the concept of product service system design and they have approached you to give a sustainable PSS design solution. Whereas, the second context is something which we call as a socio economy eco system which is define as a ecosystem wherein the economic activities of the ecosystem are deeply ingrained in the social ways of living.

Say for example, the handloom sector in our country or the craft sector. Here you cannot find one stakeholder who is a primary stakeholder this is a multi-stakeholder systems. In these context also there is hardly times when somebody approaches you that I want to make this kind of a SPSS related intervention. And because, there might be too many crafts mans, too many small companies involved in doing craft activities or handloom related activities. So, it is very difficult to identify who is my primary stakeholder.

So, in this particular context, we do the strategic analysis little differently as compared to the previous one. So, in the major difference that comes in is in the first context because we know who all are the stakeholders. So, we can directly talk to the stakeholder, understand the stakeholder, their positions what do they want and define the context intervention context. We can very easily identify who are their competitors what is their market position. But in the second context the major challenge appears in first trying to identified who all actually are the stakeholders.

So, the very first step comes in to picture in the second context is, try to identify who all are the actors. So, like we saw in the (Refer Time: 07:04) example we had to first try to find who all are the actors. So, we figure out the viewers, the different types of viewers, different types of entrepreneurs, the helpers, the people who set up the loan and an entire range of actors who are involved.

Once we have identified all the actors we have identified their role, what is their contribution, what are their problems what are the sustainability issues and very importantly what are the infrastructure related constrains. Once we have done the same we then go ahead with defining the intervention context along with the stakeholders. Apart from that all other stages of the MSDS for both the context can be almost carried similarly.

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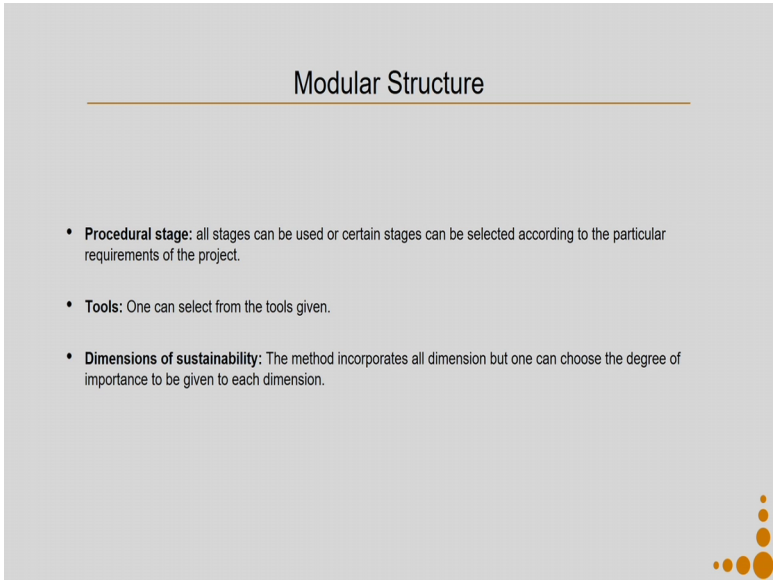

The methodology is also very modular in structure, which means you have those five procedural stages that we discuss the strategic analysis exploding opportunities, system concept design and then detailing and finally, communication. Either you can do all the stages or you can select certain stages and it will depend on the context that you are taking into consideration as well as the amount of resources that you have.

Also the tool comes up with certain kinds of tools, that we had discussed you can select to you can opt to go ahead with all the tools, but that requires lot of time. You can also select some of the tools which are more applicable for your context and you can also bring in new tools depending on the context you might feel that in this context. Some other tool which has not specifically being designed for the MSDS methodology you can also bring those tools in this particular methodology and hence this whole philosophy that it is modular structure. The third level of modularity that this MSDS methodology offers is, although it considers all the three dimensions along with many sub dimensions it allows you to give different priority levels to each one of them.

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So, if we look at all the sub dimensions. So, say for example, in system eco efficiency which is dimension 1, it consists of sub dimensions like system life optimization, transportation distribution reduction, resource reduction, waste minimization valorization conservation biocompatibility and toxicity reduction. You are given this possibility to associate different levels of priority to each of these un sub dimensions, depending on the context for which you are designing. So, that is the third modularity aspect which is offered by this particular tool.

So, because it consists of all the three dimensions so, we have the next dimension the social equity and cohesion which consists of improve employment working conditions, improve equity and justice in relation to stakeholders, enable a responsible sustainable consumption, favour or integrate the weaker and marginalized and improve social cohesion and empower or enhance local resources. Then the 3rd dimension which is the economic sustainability so, how is the market position and competitiveness, profitability or added value for company for customers long term business development risk partnership and cooperation and macroeconomic effects.

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We also discuss the SDO Toolkit which is a very important toolkit and it helps you to first assess the priority level of each of those sub dimensions, then it also helps you to assess the current status of existing best sustainable cases, if any in your context on the same three dimensions.

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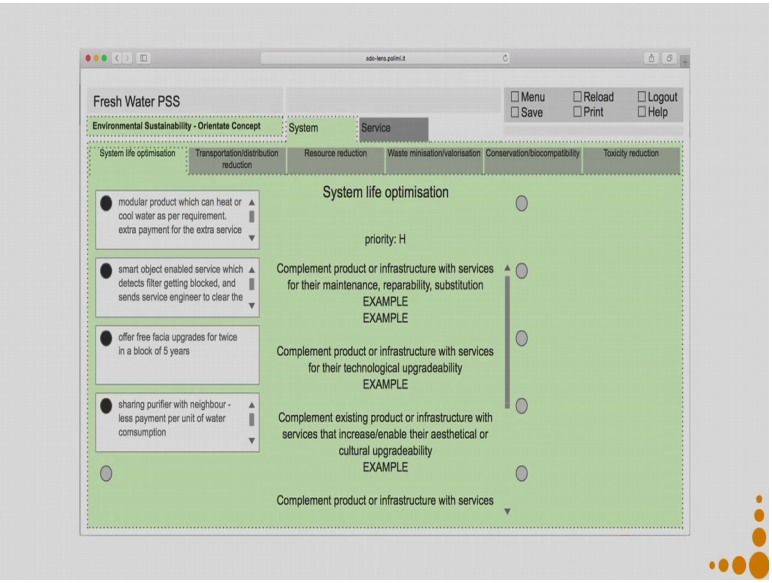

Then it helps you to ideate on system level concepts and service level concepts. It is very important to remember that the MSDS methodology is a toolkit, which is meant for making system level interventions so, that you can create a sustainable PSS system.

Because the whole in a basics of a sustainable PSS system is that it is in the economic interest of the providers to be sustainable on all the three dimensions. So, the in this particular toolkit, it helps you to come up a systems driven ideas as well as service driven ideas.

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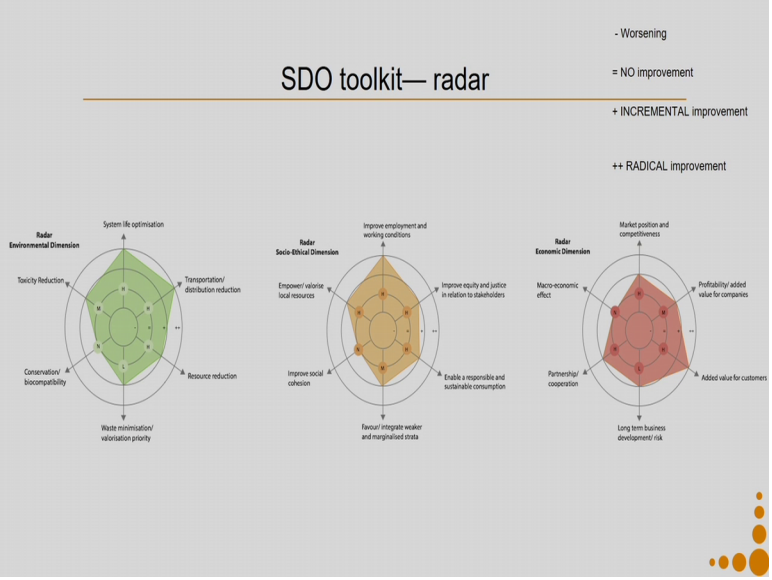

Then you can do a comparison this is a qualitative comparison that I do. So, once I have made all the design changes. So, in this particular context I this is the ideation board once the ideation board is done, you will do the system concept design then you will select one concept out of all the concepts that you have come up with then you will do the detailing of the design. Once the detailing of the design is done you can do a final assessment of the new design with respect to the existing scenario. So, you the toolkit helps you to do a qualitative judgment of the environmental dimension, the socio ethical dimension and the economic dimension with respect to all it is sub dimensions but be very careful,

This is again a qualitative judgment say for example, where you have to be very careful is, say in this dimension waste minimisation or valorization of priority. So, say for example, I replaced all parts of my product component in which plastic was being used and in place of plastic I am using wood. Now, plastic it can go into a landfill or it has to has to be incinerated or it might be downgraded, but with wood we do not have much problem it can actually go for composting. So, by considering that I might say I have

achieved waste minimisation to certain extent in my new concept. So, I would say that my concept is having a incremental improvement but that is a very very qualitative judgment.

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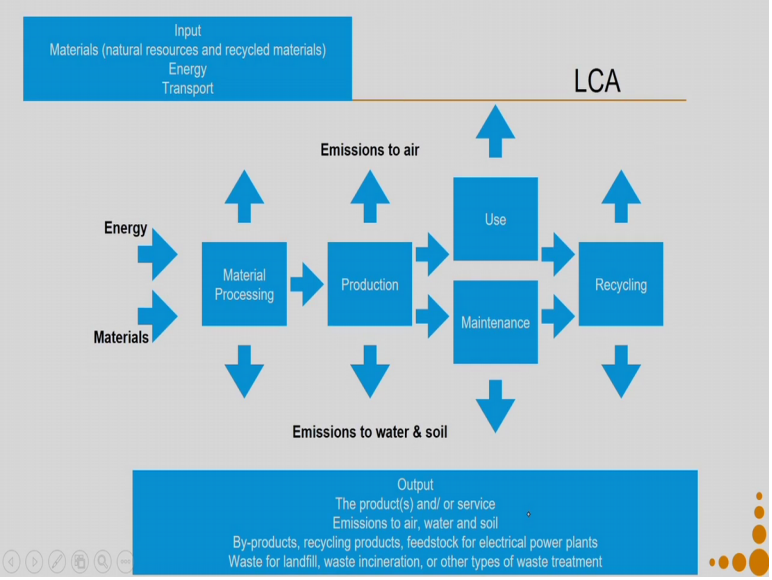

So, if you recall our life cycle assessment lectures you will remember that we had always criticized this kind of a qualitative judgment, because not necessarily the qualitative judgment is the right judgment why so? Because there are many other aspects say for example, the life of the product may be the plastic was offering longer life then wood or say for example, how the wood is transported from point a to point b or how the plastic is transported from point a to point b or may be what is the impact on the overall weight of the new product because I changed all plastic parts to wooden parts.

So, there can be many so, many other considerations. So, we actually need to compute it quantitatively. Unfortunately doing the quantitative calculation for life cycle assessment is way much more difficult way much more complicated. Doing a qualitative assessment over here is way much more easier also the quantitative assessment using LCA is more time consuming you might not have data for all the processes, for all the materials involved you also have to be very meticulous in terms of the exact quantities. So, I am going to use 100 kilo joule of energy, I should also know the energy mix of that particular location where I am going to put it.

So, because of all the complications involved there are many a times that these complications the time required the resources required non availability of all data which makes life cycle assessment a more difficult approach. Whereas, the qualitative judgment is easier approach so, of course, you cannot just on the basis of like replacing wood you cannot, only put like I have done a radical improvement.

Hence in case it is possible always go ahead with a life cycle assessment, because that gives you the best possible answer on whether the situation has worsened or it has improved on the environmental dimension. Otherwise, if that is not a possibility still you should always go ahead doing this qualitative analysis. It is better that the qualitative analysis be done with all the stakeholders the all the stakeholders can bring in better judgment possibly as compared to being done by one person.

So, if you are supposed to do a life cycle assessment of the same, new product service system design that you have done, you can identify you can put it into the stages of the life cycle assessment try to identify all the inputs and all the outputs.

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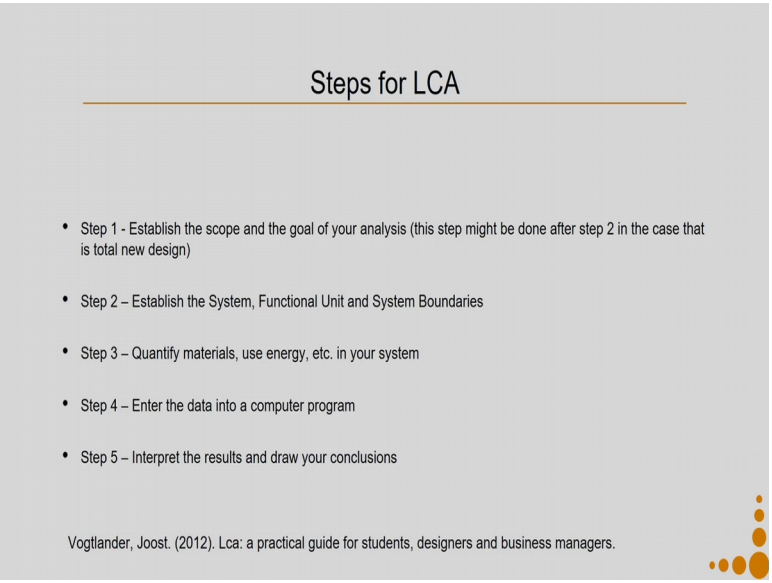

So, the steps that you will perform for doing the LCA will be first you establish the scope and goal of your analysis. Then you establish the system the functional unit and the system boundaries, then you quantify all the materials what in terms of weight how much energy you are going to use, how much distance you are going to travel and so, on in

your system. Then you enter the data into a computer program and you interpret the results and draw your conclusions.

So, step 4 will of course, give you a quantitative amount. Say so, many kgs of CO 2 equivalent or so, much of eco cause, but that value as such does not make much sense. The sense is made only when you interpret the results and draw your conclusions in order to do that you will compare the existing situation which means you have to do a life cycle assessment of the existing situation as well as the life cycle assessment of your final situation. And then with the quantitative values that you have generated you can be more sure about the environmental improvement brought in. For the social and the economic dimension the radar diagram the qualitative diagram works quite good.

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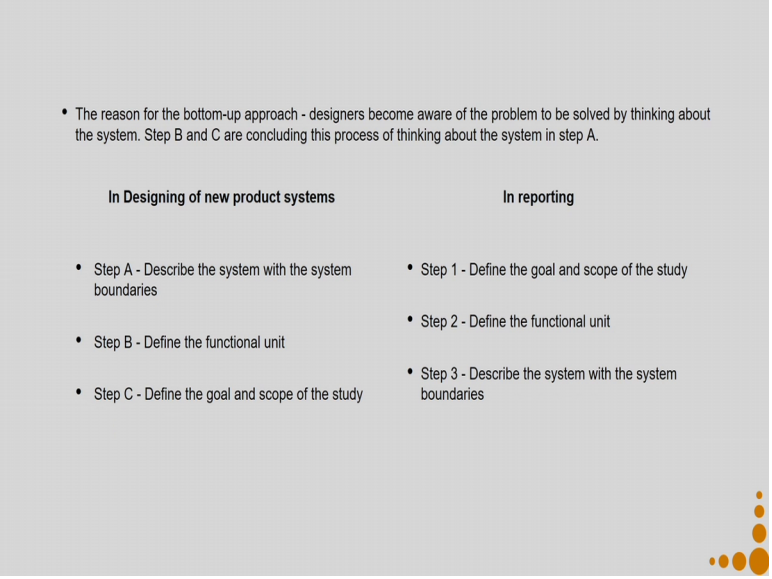

In while we were discussing the life cycle assessment, we also discuss that we might have two types of scenarios; in designing of new product systems and while we are reporting. Say for example, with your new design you want to go for certain kind of certification then in that or you want to put it into the CSR report or anything of that shot so, in that case reporting is important.

So, you will have these two different contexts designing of new product system and in reporting. In doing these two different processes we have our steps little bit different. So, step B and C are so, the reason for bottoms up approach designers become aware of the

problem to be solved by thinking about the system. Hence steps B and C are concluding this process of thinking about the system in step A.

So, when you are in the design phase; so, when you are in the design phase, your step A is describe the system with the system boundaries, then define the functional unit and then you define the goal and scope of the study. Because, when nothing exists before you do not have a design you do not you cannot start with the goal and scope.

Hence we start with describing our system and the system boundaries and then go to define the functional unit. And finally, define the goal and scope of the study, but while you are reporting it when you already know that this is my final design, your approach becomes the reverse it is like define the goal and scope of the study, then you define the functional unit and then you describe the system with the system boundaries.

Another approach that can be taken say for example, in the if you are into a design context by using the MSDS methodology, where design of the product is also an aspect of your design. As you saw the MSDS methodology, it helps you to design the whole focus is on system design and service design. But in order to improve the product aspect of its of it on the environmental dimension at the time when you are doing MSDS methodology for the design of the new PSS you can also use the ICS toolkit for the product part of it.

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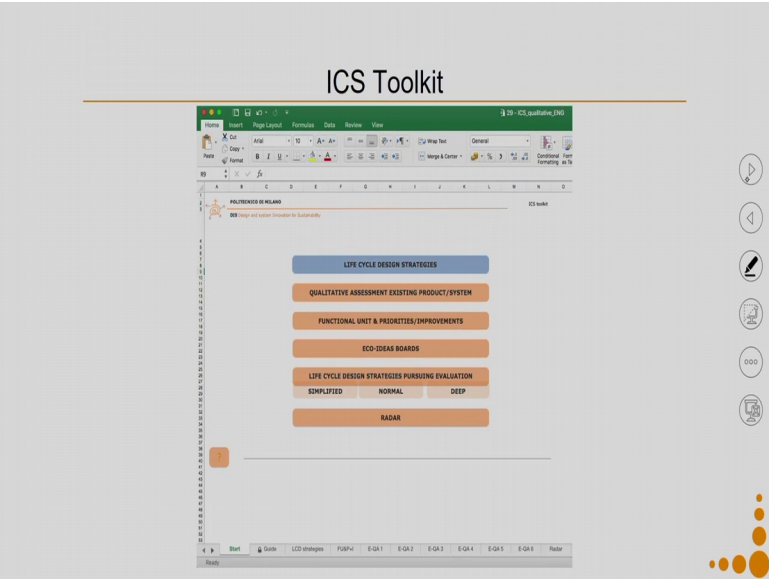

So, the ICS toolkit is a life cycle design strategies. So, although the LCA methodology the LCA assessment is more quantitative and difficult to do and requires a resources. Using the ICS toolkit is way much more easier because again it is not a quantitative tool, but it is a qualitative tool and it helps you to design so, by using certain engineering design criterion guidelines.

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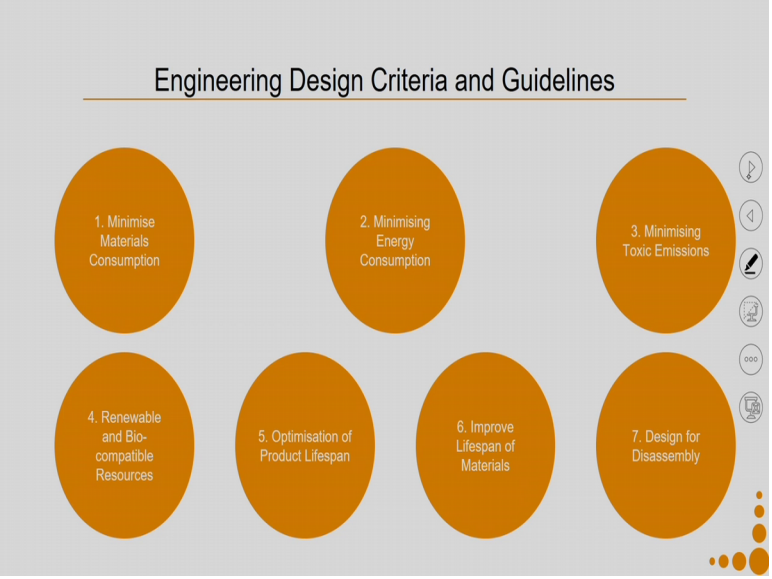

So, there a step by step guidelines in this particular ICS toolkit which help you in minimising material consumption, in minimising energy consumption, in minimising toxic emissions in use of renewable and biocompatible resources, optimisation of product life span, improve the lifespan of materials and finally, design for disassembly. And the ICS toolkit also offers you a kind of a radar diagram concept, where you can qualitatively judge either you can judge on an overall level or at a way much more granulated level qualitatively, whether you have been able to bring in environmental greater environmental sustainability in your product.

So, this is the approach by which you can combine the MSDS toolkit along with the ICS toolkit and it is always a best way that at the end of it you do a life cycle assessment as well. You can also keep on doing the life cycle assessment when you are at the system concept design level. So, you came up with five different concepts, you can also do a life cycle assessment of the five different concepts in case time is permitted. Once you do these things you can ensure higher and higher sustainability of your system design.

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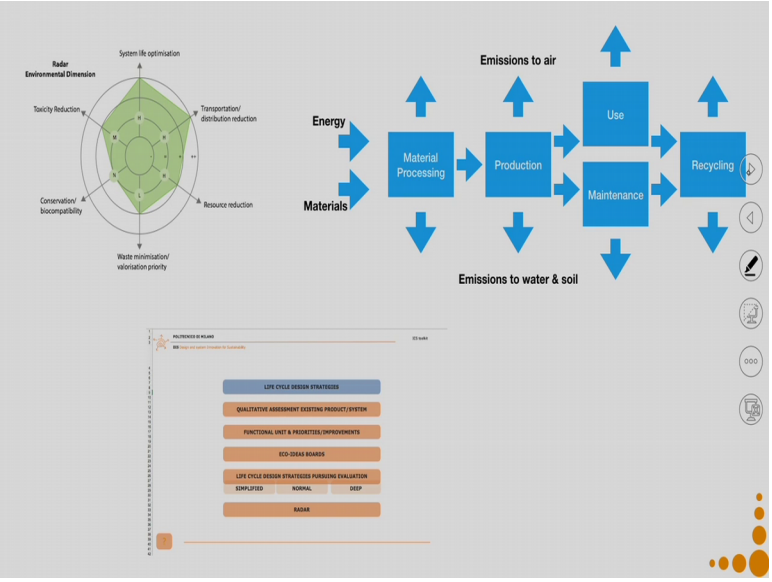

So, the combination of the three tools the SDO toolkit, the life cycle assessment and the ICS toolkit based assessment and they will be also used for they can be used all the three tools can used for design as well as for assessment. So, all of these three if, it can be used together in the context of a product survey system design, you can get a very robust sustainable solution.

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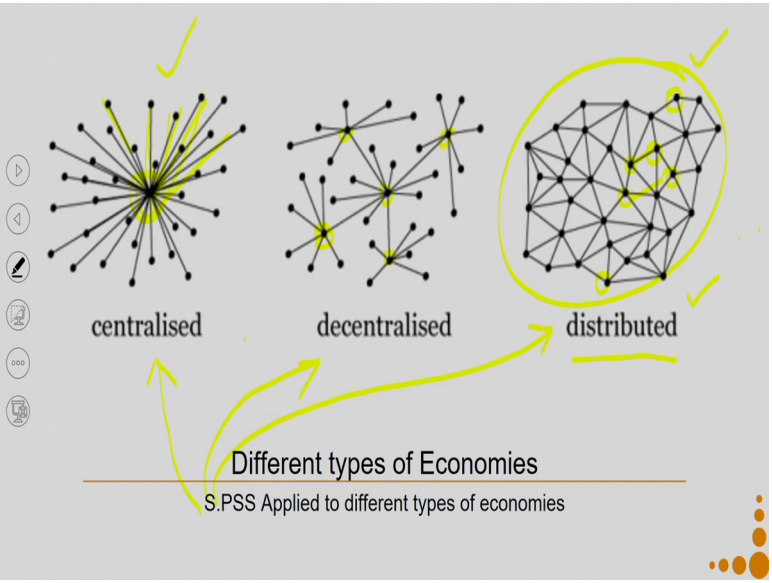

So, when we were talking about the MSDS methodology, we were concentrating on all the three dimensions of sustainability and our focus was on a product service system

design which is sustainable. Which is inherent sustainable capabilities why the inherent sustainable capabilities? Because, it is in the economic interest of the providers to be sustainable. Now, if we try to look this sustainable PSS in terms of different kinds of economies what it is? So, there are three types of economies; centralised economy, decentralised economy and distributed economy. In the context of centralised economy I have one most important hub. So, I have one most important hub say for example, thermal power plant generation it is a centralised way of producing energy and then the energy is distributed to all over the place.

I can have decentralised way of doing activity say for example, Amul has a decentralised model, where there are different people who are producing the milk and they bring it together to certain collection centers from where, it is more centralised collection centers. In distributed model say for example, there are so, each of these units is a biogas unit.

So, each and every household owns a biogas plant. So, the household waste is pumped into the biogas plant and the biogas plant supplies fuel the biogas to the kitchens of these households and all of them are connected to each other. So, I can share the raw materials so, if there is excess raw material produced in one location, say one of these locations is the restaurants. So, the chance is that there will be excessive waste over there is way much more higher, but also the chance is that their usage is also way much higher is quite higher.

So, as a result because of this network structure the inputs and outputs can be more balanced all the excesses can be more balanced. So, in this case each and every node is a producer and a consumer so, this is a approach for a distributed economy. So, now, we can apply our sustainable product survey system to each one of these economies. Say in the context of centralised economy if we apply a sustainable product survey system design.

Say for example, the example of freshwater company that we were discussing who will supply water purifiers to everybodys homes by following a SPSS model. So, in that case this fresh as a company is a centralise is operating under the centralised model. They on they have the their product and they distribute their products to different people. So, that

is a centralised way of doing activities and your SPSS is applied to this centralised economy.

Similarly, I can apply SPSS to a decentralised economy as well and a distributed economy. Say for example, if we want to have solar power generation. So, if you remember the example of empower that we give, anybody who is interested in having electricity in their home because the rural areas in that area were not connected to the mains grid. So, anybody who was interested in getting solar power energy could contact empower and empower would come and put in a solar panel in each and every house.

But the solar panels were not connect so, one house was not connected to another solar house. One house if say excess production of energy is happening in a house that is also not connected to the centralised grid. So, what I am doing is I am doing production of energy in this particular context in a distributed manner also the consumption is happening in a distributed manner.

So, in that particular context, I am bring and this is also PSS model because the owners of those households who are using the empower units, they do not own the empower unit. The solar panel, the batteries the lights the charging and all other fixture they are owned by the company empower and the consumer pays per unit of consumption so, it is a result oriented PSS. So, in this particular context this is again an SPS which is applied to a distributed economy context.

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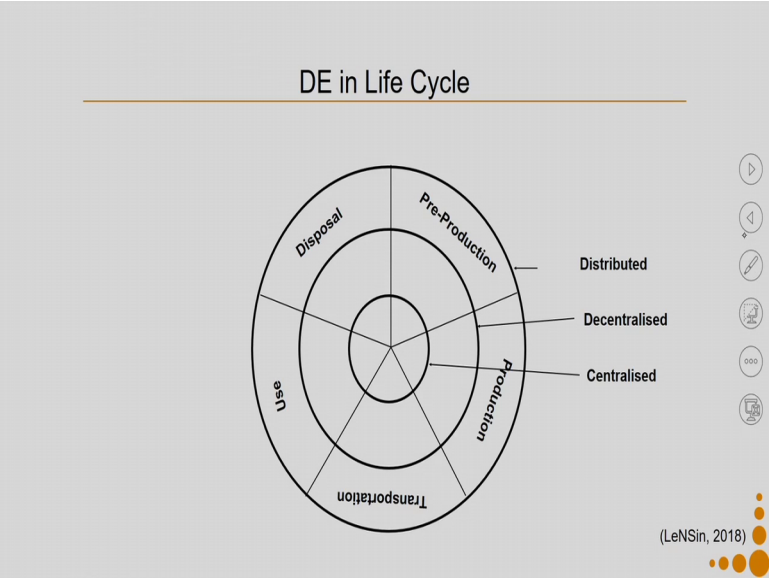

We also discuss that distributed economy in terms of life cycle. So, life cycle as you know from our LCA lecture that it will consist of preproduction production transportation use and disposal phases. So, when we talk about distributed economy, it is not necessarily it has to be distributed on all the lifecycle elements it can be, but not necessarily. So, some of the aspects can be distributed.

So, in this particular chart the outer circle represents distributed, the middle circle is for decentralised and the centers central circle is for centralized. So, when we are designing for distributed economy and we are trying to marry sustainable PSS with the distributed economic concept, we can see that across which of these lifecycle I am going to be distributed on which I am going to be decentralized and on which I am going to be centralized. So, a combination of it is possible. It is argued that SPSS applied to d has very huge potential for sustainability why so?

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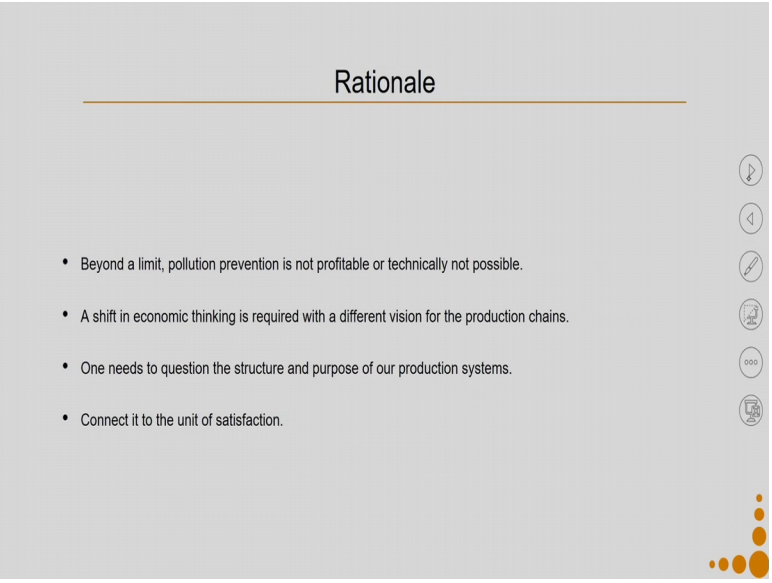

So, the rationale behind that is that beyond the limit pollution prevention is not profitable or technologically possible. So, we need to shift in our economic thinking and we have to revision how do we organize our production chains. So, that to happen one needs to question the structure and purpose of our production system and connect it to the unit of satisfaction.

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So, in the context of distributed economy, sustainable development is targeted to be achieved through regional development. And as a result it is being argued upon that the sustainability potential of SPSS applied to distributed economy is quite high so, why because, it can bring in reduction in extensive logistic related activities. If your production happens in a distributed manner you can reduce the logistics transportation as well as packaging in a big way.

The customer and production are more connected. As a result the possibility that better satisfaction is possible is way much more higher, also avoidance of activities like restructuring of manufacturing activities and outsourcing these to countries or regions with lower production cost that can be avoided. So, keeping the regional development in the region possibility of value creation connected with regions and culture which can be a very important part of social sustainability.

Possibility of using renewable energy, local material resource and manpower say because I distribute my production the scale of production will also reduce. As a result the possibility that more easily I can use renewable energy sources also grows up, I will be more able to use local material resources which will further reduce my transportation and packaging and I will also be able to use my local manpower. There is also possibility to empower individuals and community and reduce poverty and inequality through this method.

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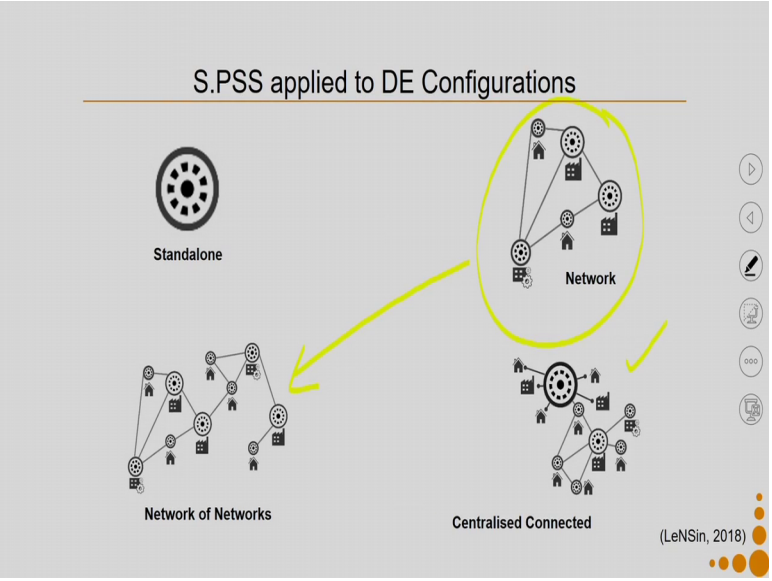

So, while we were trying to discuss this, we also came across different configurations for distributed economy. So, one concept can be like empower. So, empower can be called as a distributed economy with standalone concept because, every household which is interested in generating their own electricity by using solar panel and the services of empower, they are standalone entities they are not connected to each other. So, I am having distributed energy production happening at each individual house. So, this is a distributed configuration in which it is a standalone configuration and you can apply SPSS like empower has done in this particular context.

See if I connect these houses in to a network, what the benefit I get in this particular option is excesses produced in one place can be utilized in another place, where at that particular moment there is a excess of demand. So, as a result the network can better do utilization of resources. Say for example, if even it can give you the possibility that rather than each house owning small units it might also be all the four houses or five houses together owning a bigger unit again you can bring in SPSS applied to this network. The sustainability potential over here increases because the resource utilization is more optimal also the output generated its usage can become more optimal.

Now, say I can also have a network of networks. So, say for example, I have a big biogas plant and that is quite big, this biogas plant is fed by a say a big restaurant or a big hotel and that hotel generates lot of ways to run this biogas plant. Then there are other biogas

plants located in other networks. So, if we bring in the network aspect from here so, there are many networks and which are connected to each other through some more network elements. I can ensure way much better utilization of resources.

As a result the potential for sustainability is quite good in both the systems, in the network as well as network of networks. I also ensure that say if one particular household is not generating any waste at a given point of time because, all the members are outside all the members have gone out for a vacation. I can still ensure that my network survives my network does not collapse because one household or two household is at this moment switched off.

The third option is this network connected to a centralised unit. So, say for example, I know I can use biogas for certain extent or I can use solar energy for certain extent, but I am also connected to the main grades I am also connected to the LPG pipeline. Which ensures that a part of my consumption from the main grade or from the main LPG power plant is offset by this more renewable energy sources; me as a customer, it saves my money and it is also very good for the environment.

Again you can also have SPSS model designed for this particular context. You might also have situations in way say it is you have a smart grid. So, if I am generating lot of solar power I and I am not using that much of power, I might also have the option that I can put back the extra power generated in the system. Say for example, this can also ensure that I do not have to invest huge amounts of money in owning the battery packs in which I would have otherwise have to store all the solar energy which is generated during the daytime for usage at night time. This ensures that when it is being generated it is supplied to the mains and then proper distribution of the energy is done which is very efficiently done by the mains grid.

So, all these configuration offers SPSS possibilities and they have varying degrees of sustainability capability. So, in the context of the SPSS methodology we discuss certain key tools for sustainability orientation the most important because we are making a systems map.

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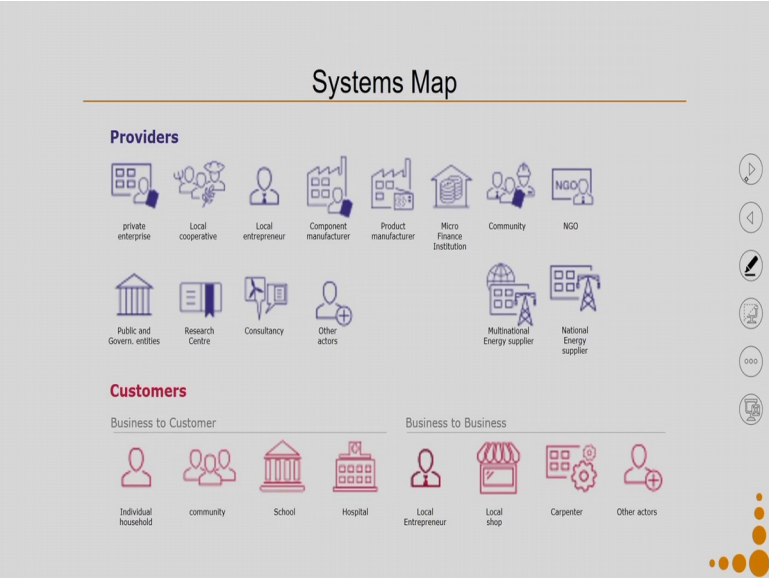

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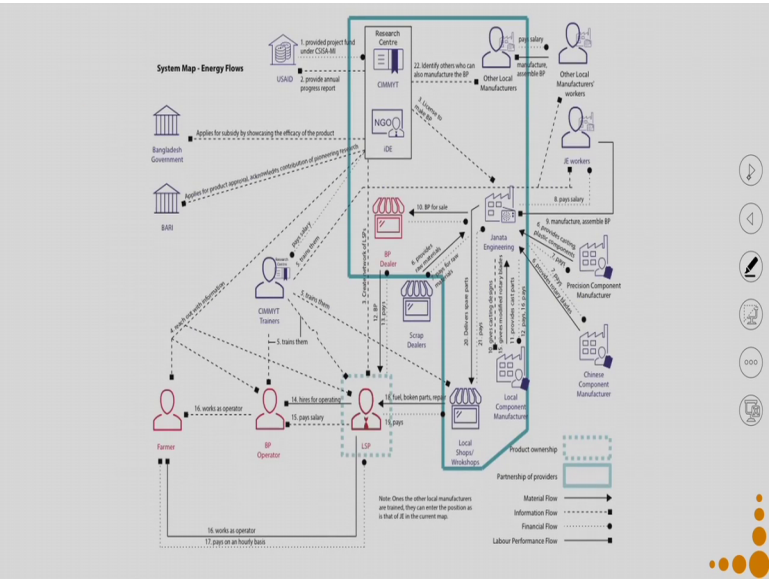

So, we should always create the systems map consisting of the list first list of all providers, all the stakeholders who are providers, all the stakeholders who are customers then we create the energy flow map, which will consist of the material flow information flow, financial flow and labour performance. We have to also highlight what is the partnership of the providers and who is going to be the owner of the product?

We write down what is flowing between them and we can also put them a sequence like 1 2 3 4 so, that for anybody who wants to read this particular map is easy for them. We

have to create the systems map at different levels so, at the starting of the project when we are doing the existing map when we are making system concepts. So, for each of those system concepts for our final design we have to also make systems map for our best case sustainability cases.

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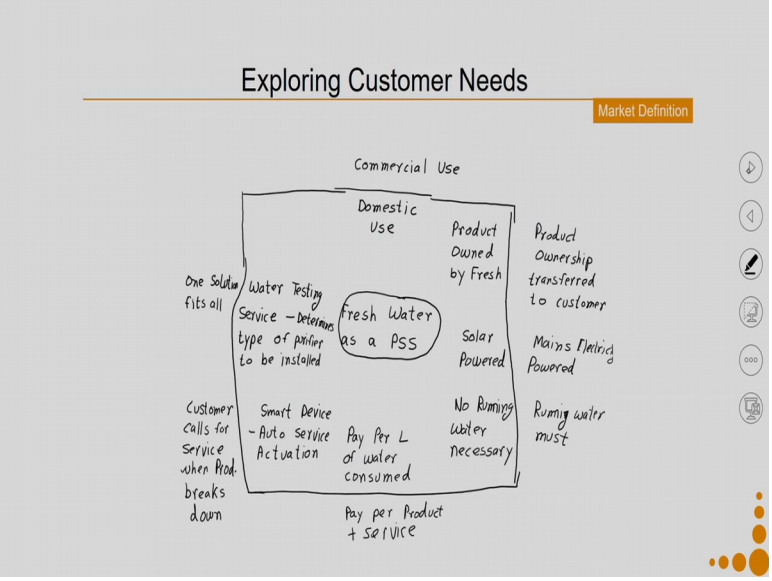

Then we are talking about exploring customer needs, very important we have to do the market definition, how do I do my market definition is I first put my market definition ok. So, fresh water as a PSS, then what all is included inside it and what all is not included outside it.

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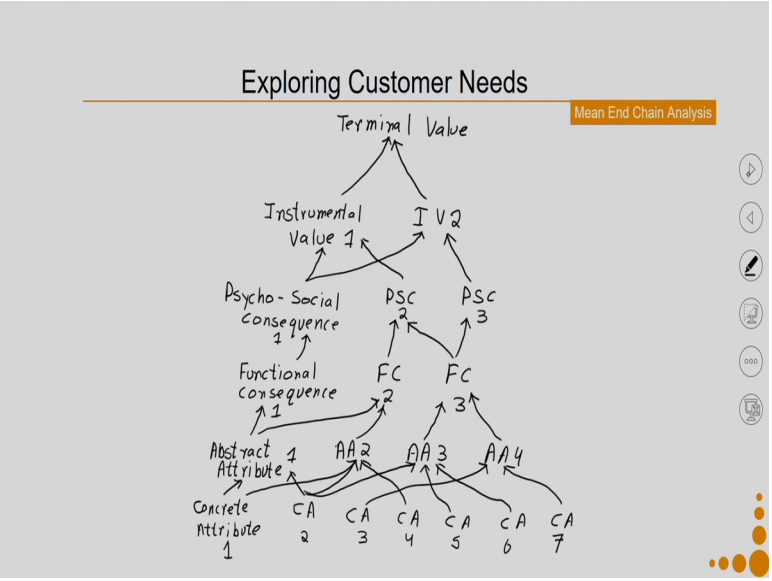

Once I have done that, another very very important step is doing the means end chain analysis, where I first try to identify all the abstract attributes required to make my PSS a successful PSS, I convert those abstract attributes into concrete attributes. So, concrete attributes are nothing, but technical specifications. It will define your concept in terms of say for example; the solar panel should generate energy for energy equivalent to 250 watts per hour. So, that is a concrete attribute from the abstract attribute we define the functional consequences, then the psycho social consequences from it arises the instrumental values and finally, the terminal value.

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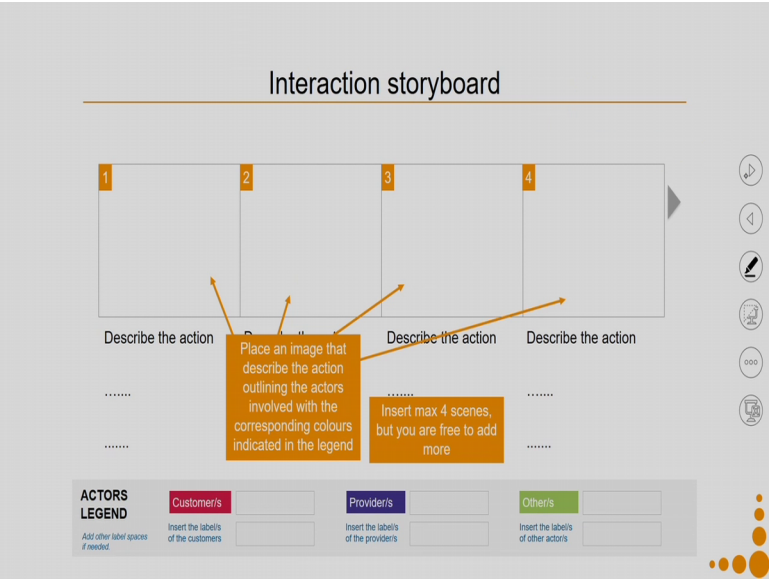

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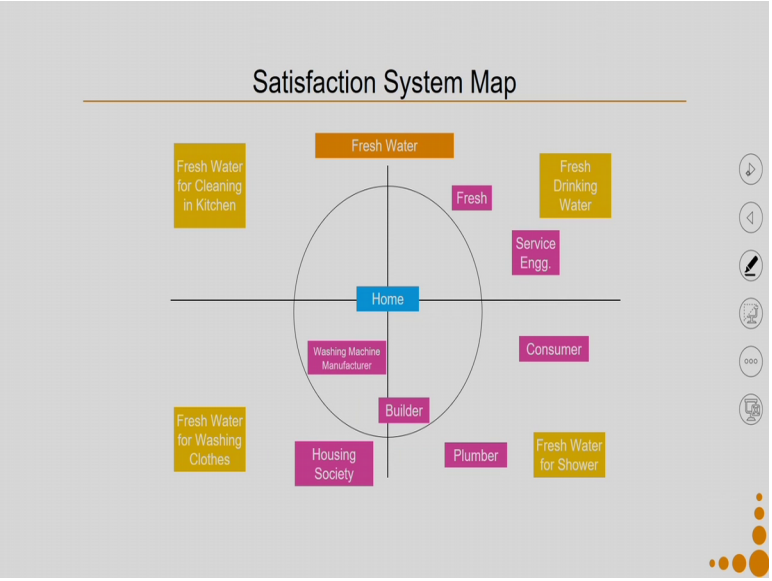

We try to map out all those interactions which are important for having the sustainability built in. In interaction storyboard we expand our scope of the PSS by using the satisfaction system map. So, this was my first scope then I see where all I can apply it what can be my further extended scope. So, I extend my scope and I see which all stakeholders. So, here you can see all the stakeholders they remain the same irrespective of what system what satisfaction system I am talking about and there are certain specific which are applicable only to the given subsystems by using this we can expand the scope of our SPSS.

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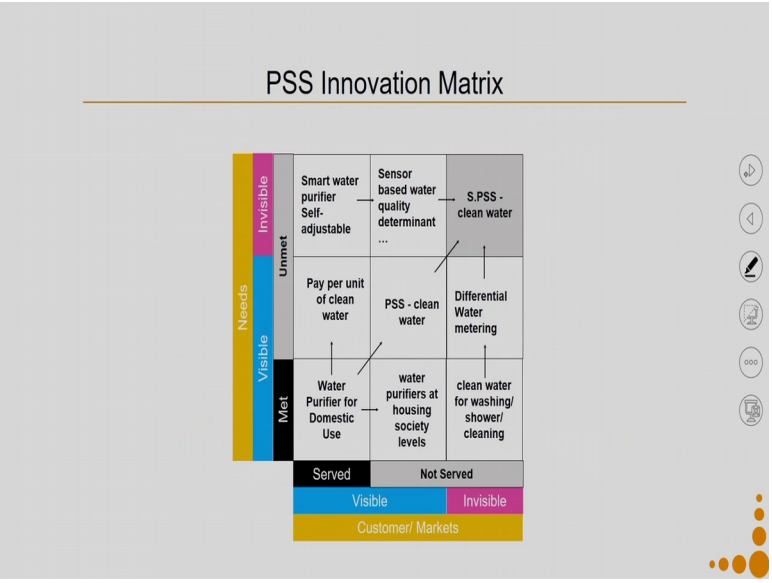

You can also use the PSS innovation matrix to identify the unmet invisible needs and not served invisible customer needs. And see if you can design products over here, which will ensure possible greater success also better immunity from the competitors for a little longer time frame.

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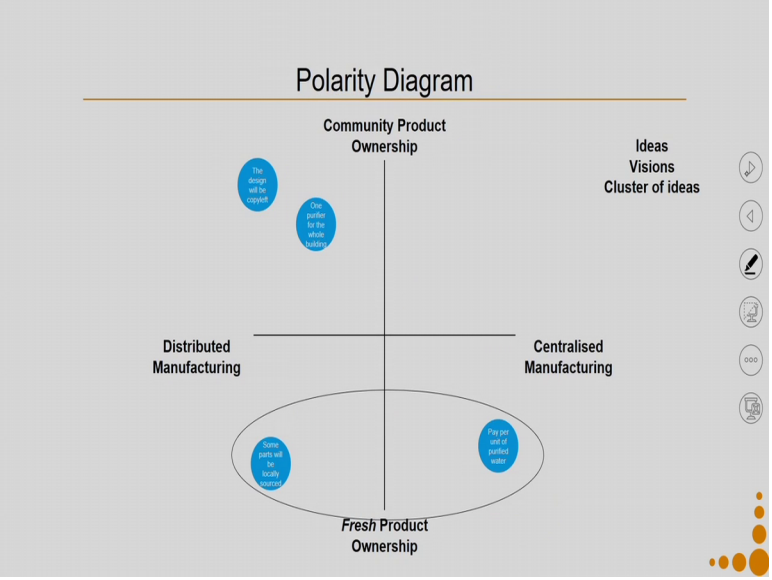

We also spoke about the polarity diagram as one of the very key important diagram, because it helps you to think in terms of polarities and that too polarities which are cross to each other. It further helps me to widen the number of ideas that I have, it also helps me in greater granularity I can analyze my ideas and see if it has certain kind of drawbacks sustainability related drawbacks or feasibility related drawbacks how can I improve it further.

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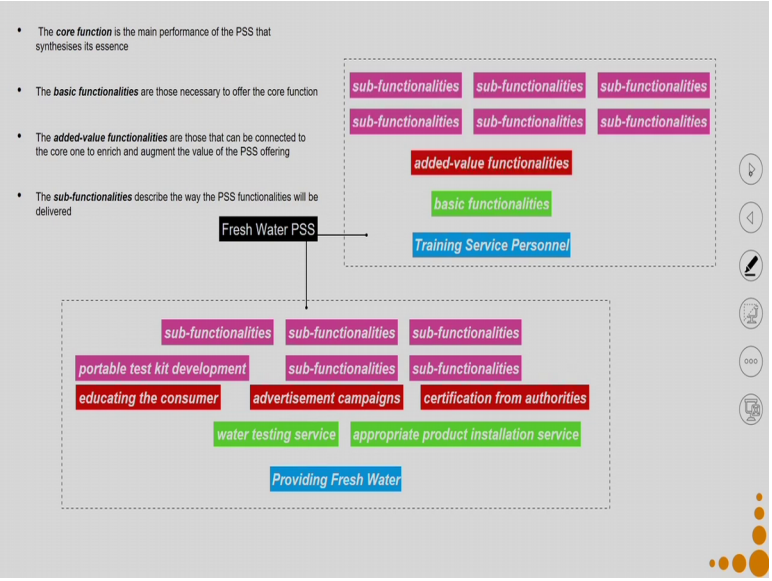

Then we spoke about that we should define our core functionalities, basic functionalities, added value functionalities and sub functionalities that helps us to understand what the um SPSS is going to offer.

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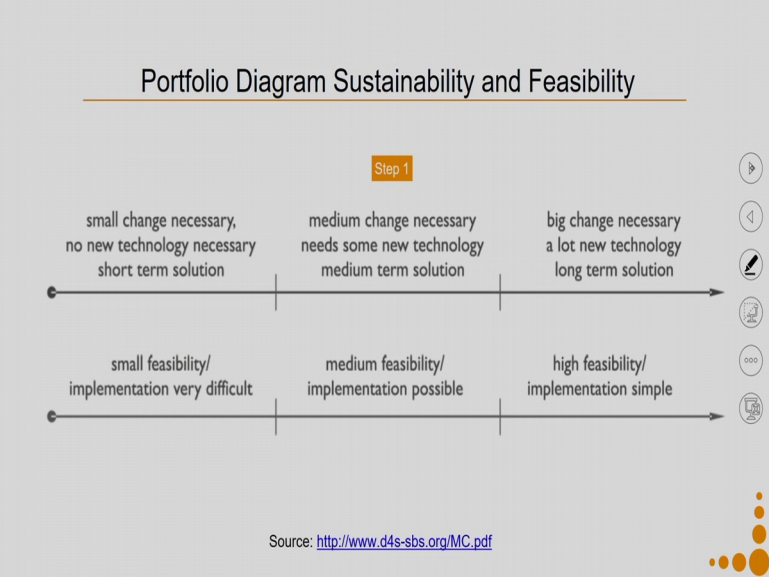

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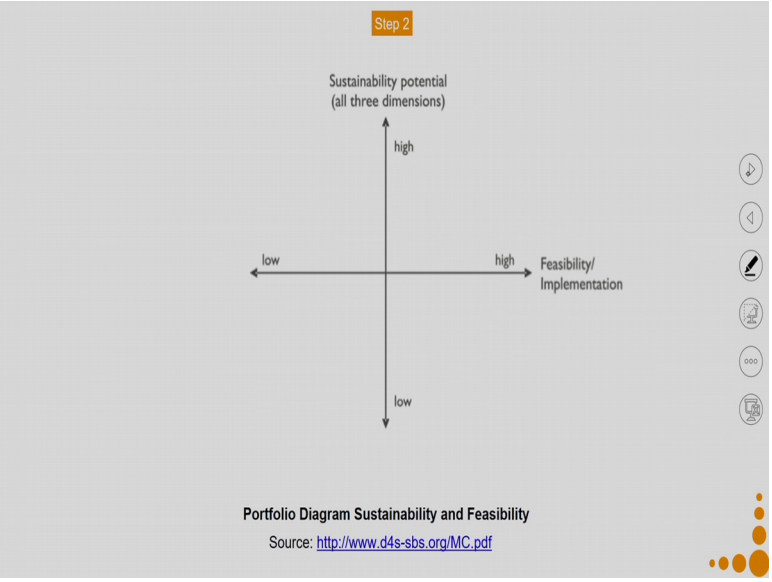

Then we try to understand it is feasibility technological feasibility and then in terms of implementation. Then again we cross this aspect with the sustainability potentials. So, we would like to have all those concepts all those ideas taken forward in which case the sustainability potential is high. So, the sustainability potential is high and also feasibility potential is high they are ideally the best solutions.

Solutions which will lie say somewhere over here feasibility is low, but sustainability is high, we can strategize how can we increase their feasibility if at all possible maybe in terms of time frames maybe in terms of resources.

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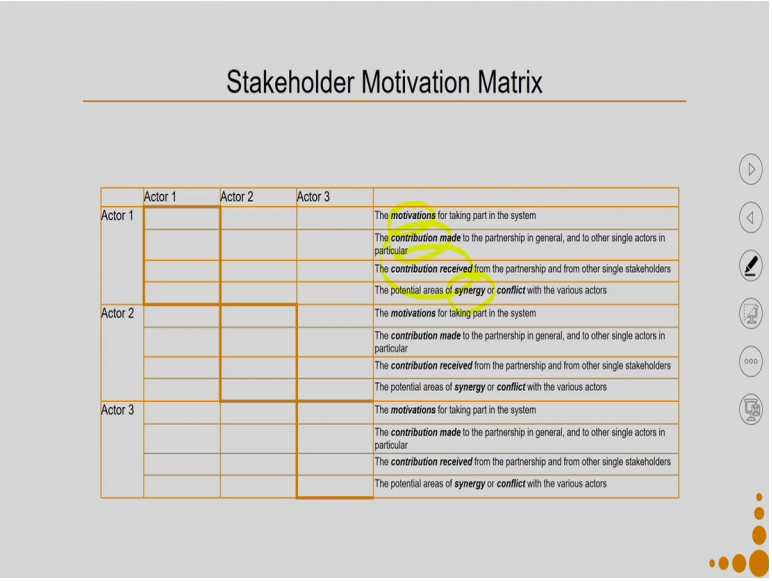

We also spoke about creating the stakeholder motivation matrix because so, we are talking about motivation contribution made contribution received and synergy of all actors in world. Because only when we have clearly designed and defined all these things for all the stakeholders (Refer Time: 43:32) we can ensure greater chances of the success of the SPSS.

Once we were done with this particular methodology, we went into discussion of sustainable tools from other disciplines. So, now, we will try to see how these tools for sustainability are actually created and say for example, you come across design scenario, which is quite different from all the context that we have design you will still need certain kind of tools.

So, when we are doing a summary of sustainability tools from other disciplines, that is what we will try to discuss. Like, if you come up with completely new scenario or you come up with a hybrid scenario. So, you say you want to do an SPSS design for the agricultural field. How you can modify your tools or how you can marry your tools so, what can be your strategy?

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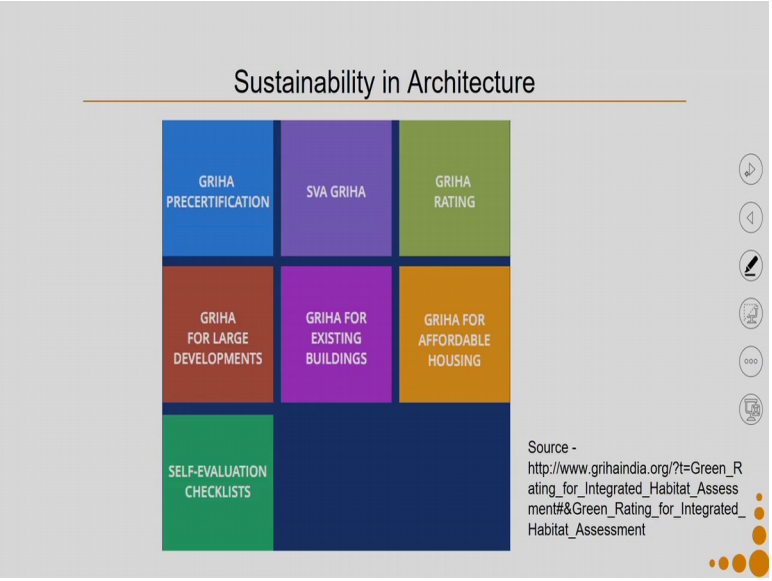

So, let us start with architecture. So, when we were looking through the tools for architecture we saw that because architecture can be at different scales.

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They can be at the scales of say new buildings, existing buildings, green homes as big as residential societies they can be even more complicated like factory buildings they can be something like villages, green cities townships. So, in terms of architecture all these are very different in terms of scale, complexity their requirements and so on. And hence

in this particular domain, they have been specific tools designed which can help in assessment of the particular context in hand.

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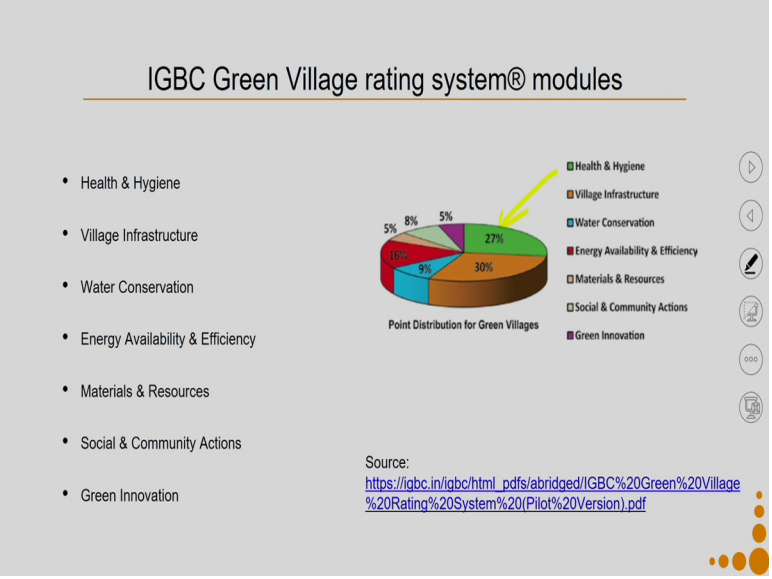

So, say for example, with green villages what we discussed i, they have the following criteria health and hygiene now we are talking about a village. So, health and hygiene, village infrastructure, water conservation, energy availability and efficiency materials and resources, social and community actions. You can see that all the three dimensions we are trying to touch upon them by all these aspects all the three dimensions of sustainability. And at the same time we are trying to modify our criteria or guidelines for doing the same, as per what it might be more contextual for a village.

When I say health and hygiene I can way much more easily understand the social dimension in terms of health and hygiene rather than keeping it as broad as social. Then green innovation so, again various weightages are given to each of these dimensions. So, say you can see that the health and hygiene has 27 percent weightages. So, many researchers have worked together and come up with these weightages.

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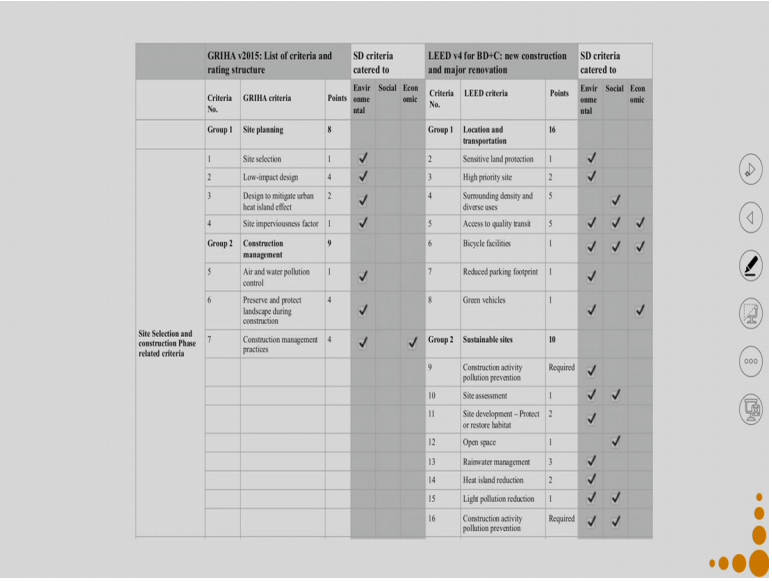

	GRIHA v2015: List of criteria and rating structure			SD criteria catered to			LEED v4 for BD+C: new construction and major renovation			SD criteria catered to		
	Criteria No.	GRIHA criteria	Points	Environmental	Social	Economic	Criteria No.	LEED criteria	Points	Environmental	Social	Economic
	Group 1	**Site planning**	**8**				**Group 1**	**Location and transportation**	**16**			
Site Selection and construction Phase related criteria	1	Site selection	1	✓			2	Sensitive land protection	1	✓		
	2	Low-impact design	4	✓			3	High priority site	2	✓		
	3	Design to mitigate urban heat island effect	2	✓			4	Surrounding density and diverse uses	5		✓	
	4	Site imperviousness factor	1	✓			5	Access to quality transit	5	✓	✓	✓
	Group 2	**Construction management**	**9**				6	Bicycle facilities	1	✓	✓	✓
	5	Air and water pollution control	1	✓			7	Reduced parking footprint	1	✓		
	6	Preserve and protect landscape during construction	4	✓			8	Green vehicles	1	✓		✓
	7	Construction management practices	4	✓		✓	**Group 2**	**Sustainable sites**	**10**			
							9	Construction activity pollution prevention	Required	✓		
							10	Site assessment	1	✓	✓	
							11	Site development – Protect or restore habitat	2	✓		
							12	Open space	1		✓	
							13	Rainwater management	3	✓		
							14	Heat island reduction	2	✓		
							15	Light pollution reduction	1	✓	✓	
							16	Construction activity pollution prevention	Required	✓	✓	

We also discussed that we took two of the existing matrices from the field of architecture. So, we took the GRIHA version 2015 for new construction and LEED version 4 for new construction and we tried to compare them on the sustainable development criteria, which is the three criteria that you have environment, social and economic. To see which of these sub points catered to the requirements of environmental social or economic.

When we were doing this comparison we identified that GRIHA is very its criteria as quite elaborate on the environmental dimension, but it lacks criteria on the social and economic dimension. So, that is where we have a potential for improving the matrix in itself. So, if you keep the basic idea of sustainable development on three dimensions, you take that criteria to a given context, you all you have to do is how do I reword all those criteria involved which are more contextual to the given context.

So, say for example, in the context of architecture, new building site selection low impact design, design to mitigate urban heat island effect. Site impervious factor they are very important and they are contextual to a building.

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Again coming to the domain of agriculture and sustainability we discussed couple of tools like SAFA RISE and COSA and KSNL.

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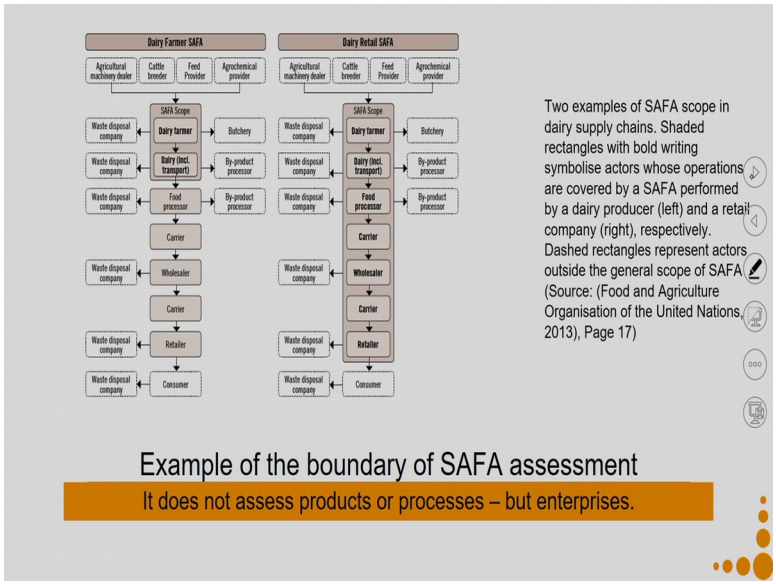

Again we saw each tool they first try to define what is this scope of work. So, say for example SAFA, it does not access products or processes, but it accesses enterprises. Hence, you can see first what they do is they define the enterprise scope so, this is one enterprise, this is another enterprise. So, first they the given sustainability assessment or given sustainability orienting design tool we will first set the boundary what it is meant

for. Then within the boundary it will try to see how I can modify the three dimensions of sustainability.

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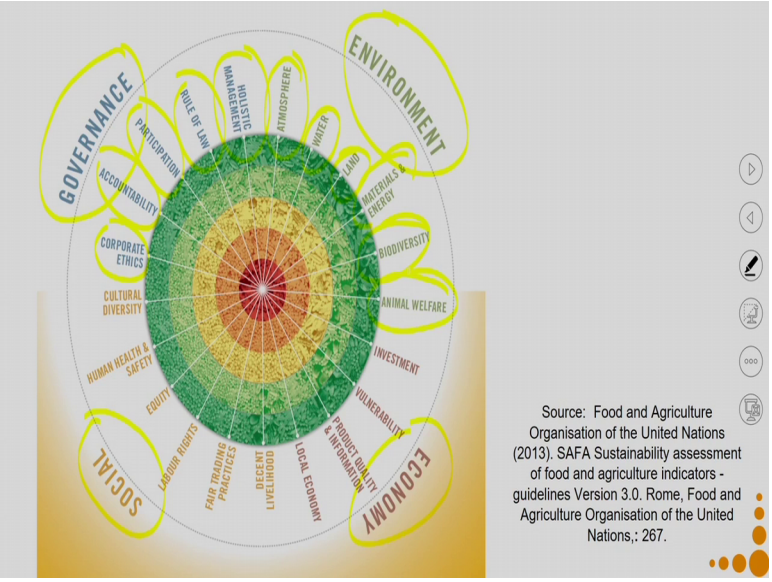

Say for example, in this case because I am talking about enterprises. So, I have my domain environment economy and social, but because it is about organisation I am bringing in governance because that is what is important for a organisation. So, you can see I have corporate ethics; I have accountability participation, rule of law holistic management.

Also we might have to refine the words for environment so, in this case because I am in the context of agriculture, I am defining environment as atmosphere water land materials and energy biodiversity animal welfare. So, the first define the context then define the boundary that you will be taking into consideration, then take the three dimensions and elaborate the three dimensions in the context of your boundary.

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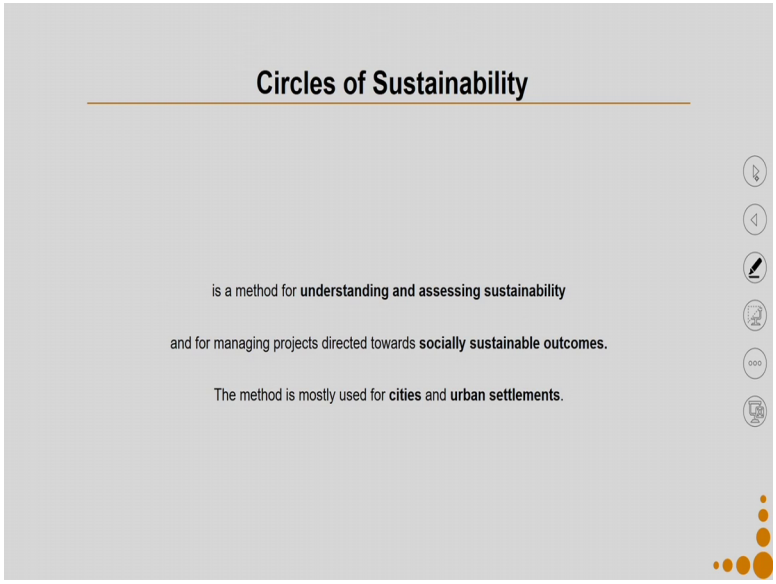

Coming to that of the cities and communities, in the cities and communities it was identified that it is very important to understand social sustainability, because all cities, all urban settlements they are about large number of people coming together and trying to achieve certain things.

So, it is the social interaction with the environment, social interaction with the economy, social interaction with the culture. So, it is in the context of social hence the circles of sustainability because they are concerned about cities and urban settlements they took the guiding principle as socially sustainable outcomes.

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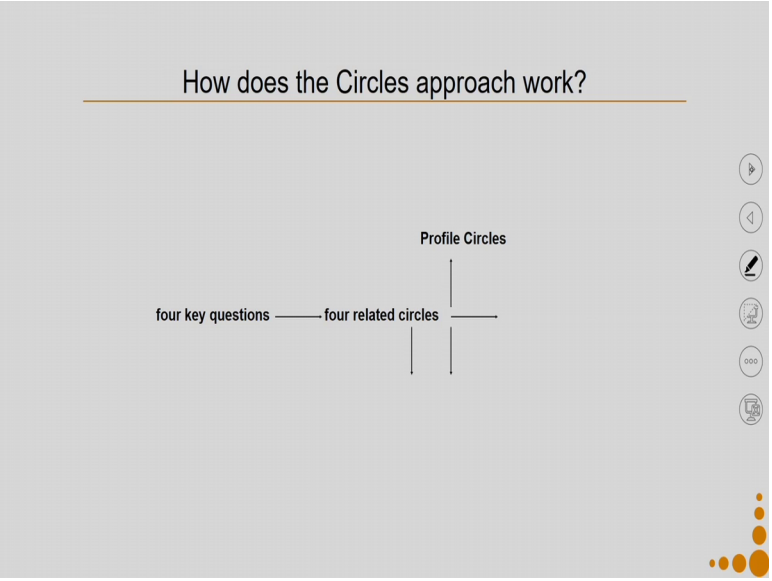

And as a result they came up with four key questions related to four circles, which are the profile circles which are nothing, but an elaboration of.

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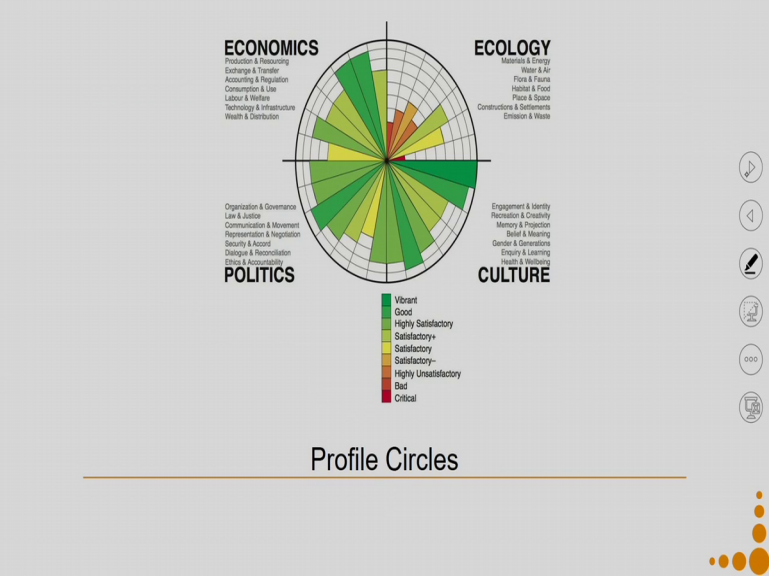

So, the profile circles and are an elaboration of the three dimensions of sustainability in the context of cities and urban settlements with the social sustainability outcome as the main aspect in mind. So, here you can see when I am talking about the dimension of ecology as we had does discussed; it is the it is in the interaction of the human element with and within the ecology with materials energy water air and so on. Since the social is

very important it has also been divided into two aspects the politics and the culture in order to get way much better granularity of this picture.

Because, we have so, many tools already available and so, many dimensions so, many sub dimension already available. So, in case you have to come up with altogether new kind of dimensions which are more suitable for your project a good approach can also be like you sit with all the dimensions that we have discussed and for your given context you pick up the ones which will be more applicable to your context.

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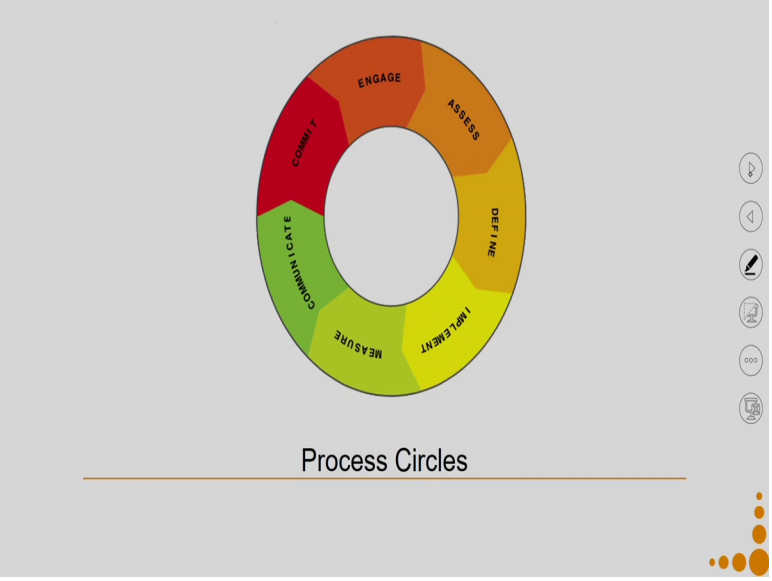

Because in so, when we are talking about the sustainability tools, there are two types of tools there are design tools and there are assessment tools. So, whenever there is only an assessment tool so, it helps you to do just assessment, but still the circles of sustainability is also design tool its design plus assessment tool. So, it also consists of the process circle which tells you if you have to go through the whole process of creating sustainable cities and communities you can take up this process.

So, the MSDS method was a design method, similarly the circles for sustainability is also a design method. A design method will of course, always have an assessment component into it because both of them are design method so, they consist of processes. So, if you think of the processes that were involved in the MSDS method, the strategic analysis related processes the exploring opportunities related processes, similarly we have

processes over here which are customised to the requirements that one has for the context of cities or urban settlements.

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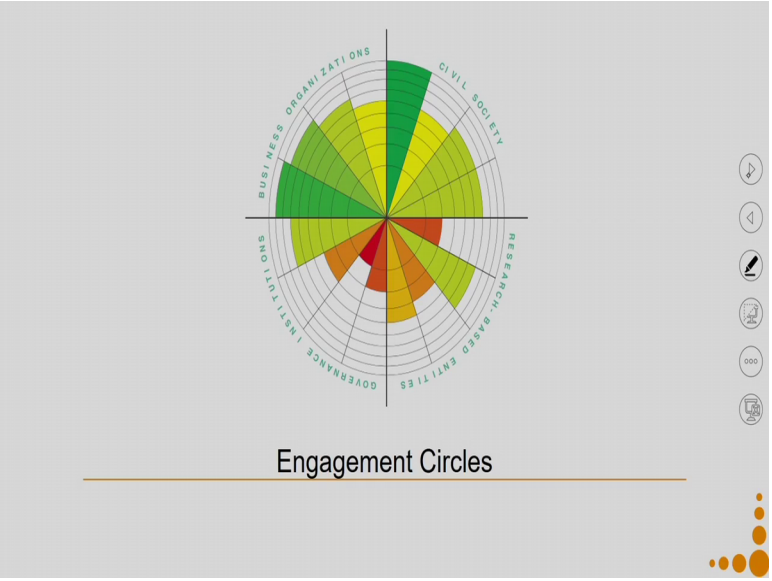

Because, it is about cities and urban settlements and we need to bring in a large number of stakeholders. So, they also have this engagement circles, which helps to understand how to build an engagement with different kinds of entities. So, with civil entities there are four different types of civil entities similarly research based entities, they are also four types government institutions and business organizations. When they are divided into four types the aim was to cover as many typologies as possible.

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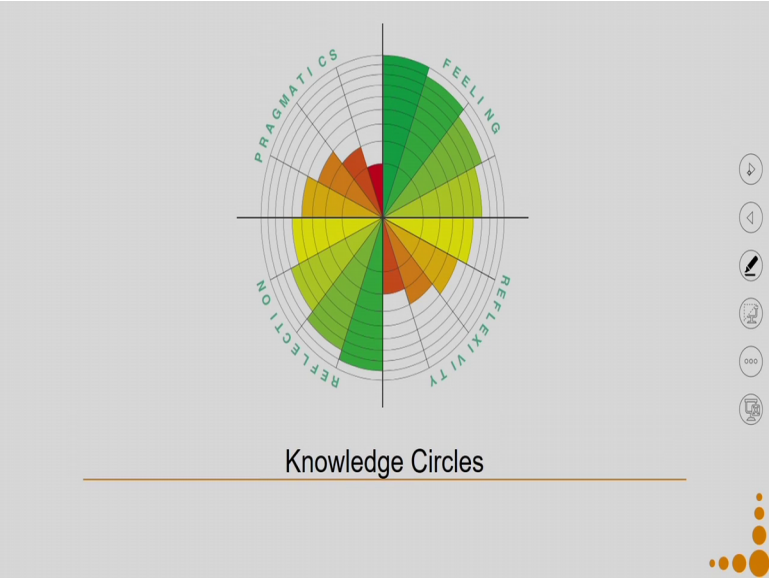

Finally, comes the knowledge circle, because in order to have a social sustainability socially oriented, sustainability tool you have to also know how people learn things, how people make meaning out of things and it is in those learning processes and meaning that using them you can build in sustainability.

Hence this tool also has something which is called as the knowledge circles which tries to identify how people learn how people build up the knowledge how people make meanings. So, again four parameters on the basis of feelings, on the basis of pragmatics, on the basis of reflection and on the basis of reflexivity so, that was all about the tools which are more holistic in nature.

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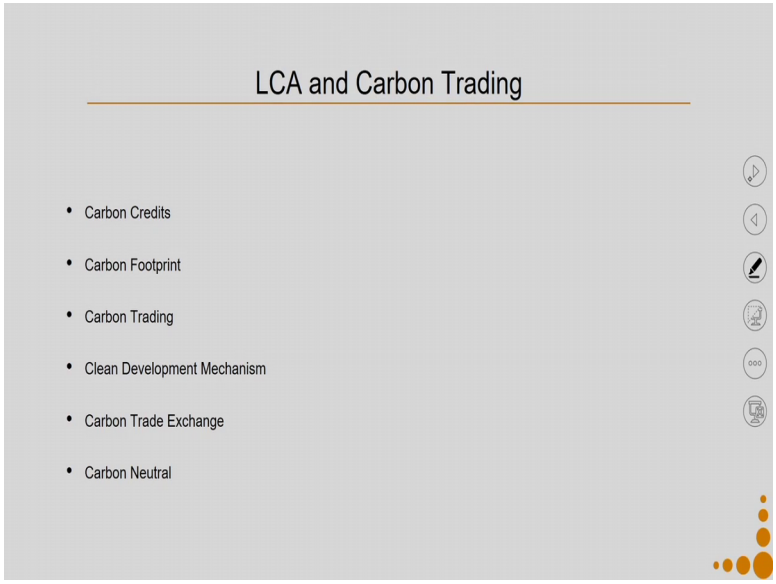

Now, let us come to tools which are more environmentally oriented, more oriented towards the LCA related approach. So, in our um lecture on carbon trading, we try to understand what how the life cycle assessment has been commercialised in a particular manner. So, in carbon trading we learned about concepts related to carbon credits, carbon footprint, clean development mechanism, carbon trade exchange and carbon neutral organisations.

So, in this particular concept we realise that, there can be way many more scopes of making commerce out of aspects related to sustainability. So, that brings us to the end of this particular course, hope you had a good journey learning about the different concepts of sustainability and you will be able to apply in all that you do to certain extent some of these concepts that have been discussed in this particular course.

Thank you so much.