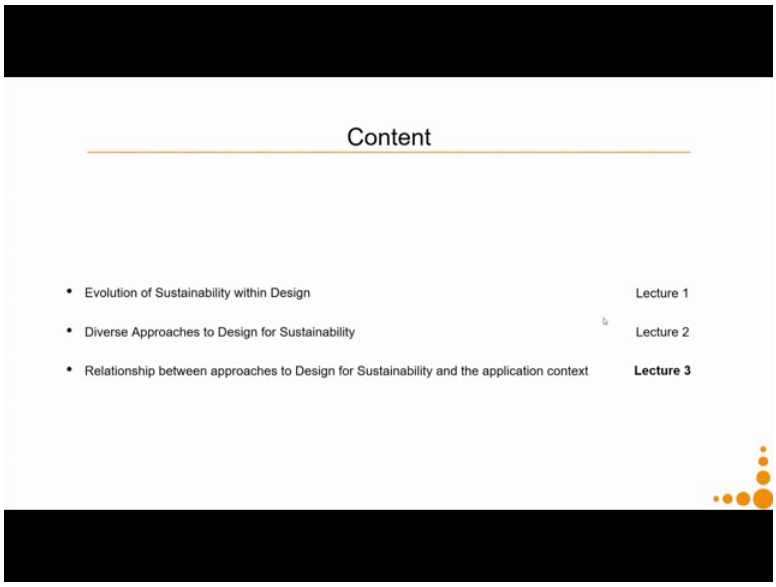
System Design for Sustainability
Prof. Sharmistha Banerjee
Department of Design
Indian Institute of Technology, Guwahati

Week - 03
Lecture – 01
Relationship between approaches to Design for Sustainability and the application context.

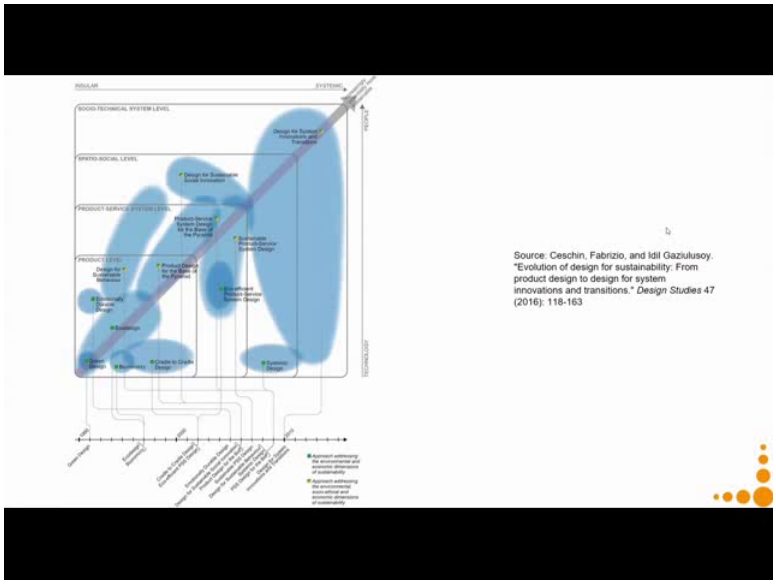
Welcome to the first lecture of this week, this is the last lecture in the module 01 which was about understanding sustainability and sustainable development. So, what we will do in this particular lecture is Relationship between approaches to Design for Sustainability and the application context.

(Refer Slide Time: 00:44)



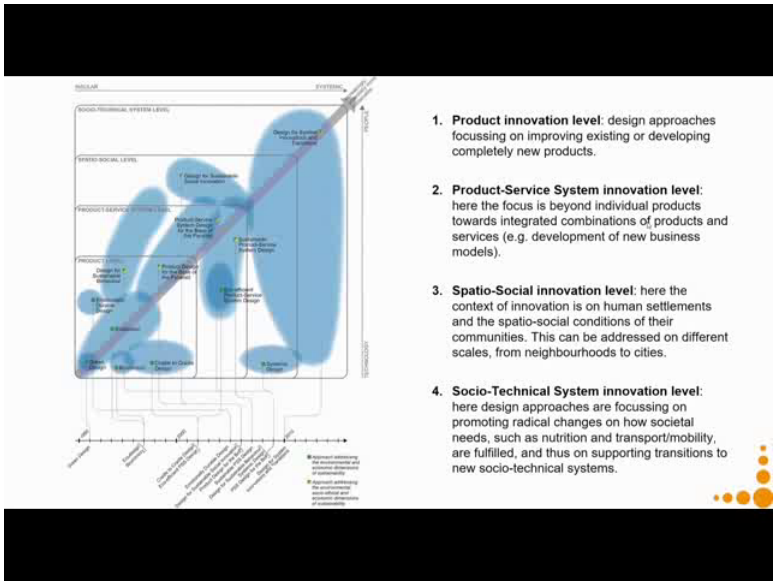
So, we will take an example and try to see how on diverse approaches can apply to a given problem context.

(Refer Slide Time: 00:59)



So, as we discussed in the last week the system design for sustainability or design for sustainability can be approach at the four different levels that is the product level.

(Refer Slide Time: 01:06)



where product innovation level where design approaches focus on improving existing or developing completely new products.

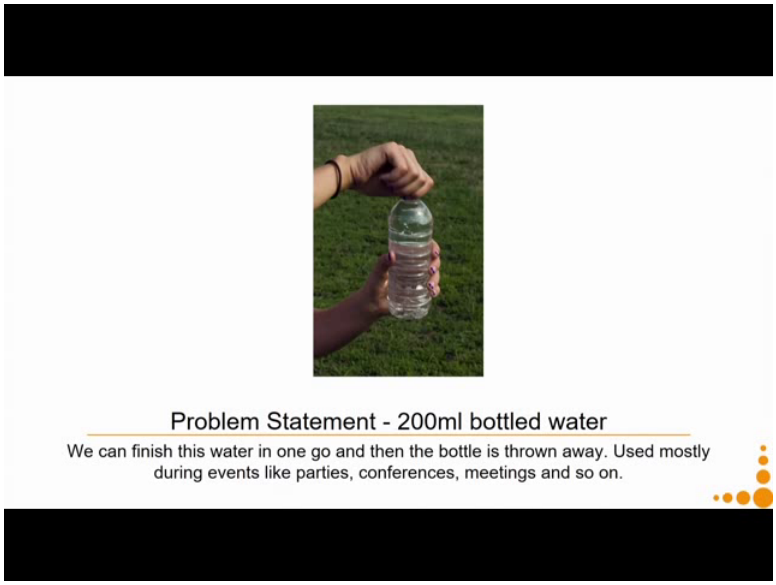
In product service system innovation level the focus is beyond individual product stores integrated combination of products and services, spatio social innovation level. Here the context of innovation is on human settlements and the spatio social conditions of their communities, this can be addressed on different scales from neighborhoods 2 cities. The

fourth level is the socio innovation level here design approaches are focusing on promoting radical changes on how societal needs such as nutrition and transport or mobility are fulfilled and thus on supporting transitions to new socio technical systems.

I would suggest that when you are going through this particular lecture, if you also keep the last 2 lectures that is lecture 2 A and 2 B. So, the lecture 2 A and 2 B which was talking about diverse approaches to design for sustainability. If you keep that particular presentation also open in your laptop screen it will be great.

So, when I take you through one particular example, if you want to recall what that particular approach was you can pause the video and go back to that particular slide read about it and then again restart the lecture on the example.

(Refer Slide Time: 02:41)



So, the problem statement that we will be taking forward in today's lecture is. So, you see this 200 ml liter water bottle, it is a plastic bottle the body of the bottle, the transparent part, this part is made up of a plastic called polyethylene terephthalate PET and the cap and the small ring at the cap, they are made up of another plastic called polypropylene PP.

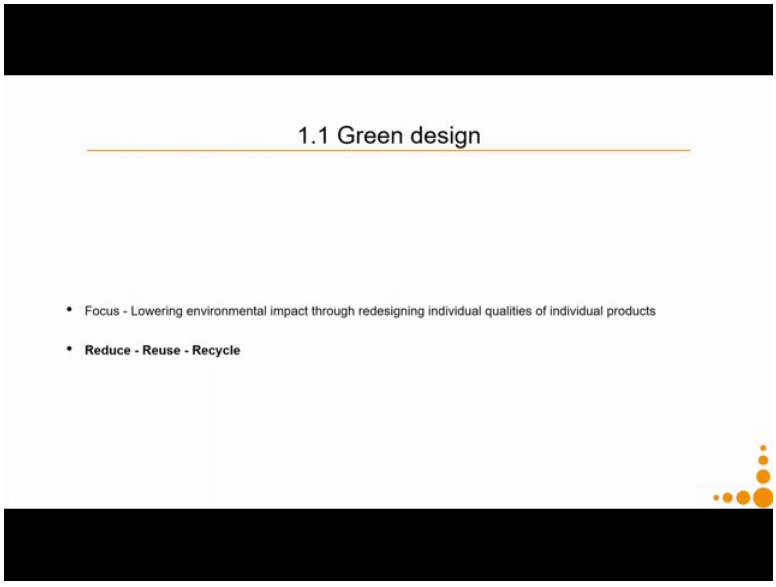
So, we can finish this water in almost one go and then the bottle is thrown away it is used mostly during events like parties conferences meetings and so on we might argue that why not give a bigger bottle say a 1 liter bottle or say 500 ml bottle. Because say, if this

event is going to run for couple of hours, you might need to have more water which you will keep on drinking after regular intervals of times. But usually it has been observed that if it is a 500 ml bottle mostly the water goes wasted because people usually do not like to carry bottle around them or they might just leave the bottle at some place and then forget about it or they have no way to know which one is there a bottle.

So, usually it is observed that giving a 200 ml bottle is a more optimal size rather than giving 500 liter 500 ml bottle and of course, not 100 ml bottle. Now you can imagine the amount of waste that is being created because of these bottles during any event. You might also like to go for these bottle say in an airport or such similar kind of context by you just want to have a drink of water and throw away the bottle.

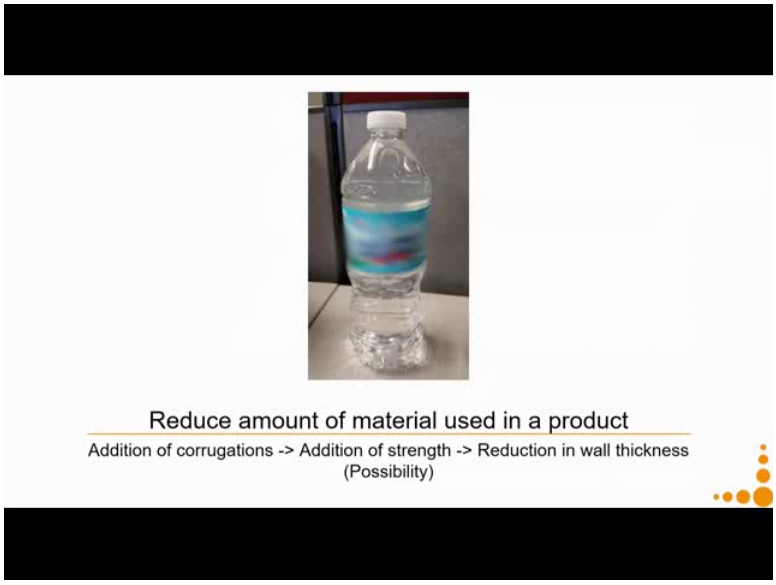
So, let us try to look at the different approaches and how each of these approaches, we will try to solve this particular problem. So, first we start with the product innovation level.

(Refer Slide Time: 04:29)



So, the first approach in this product innovation level was the Green design I will not go through the details of these, but I have tried to incorporate 1 slide. So, that it helps you in recalling what the definition of that particular context was and we can go to the example. So, in green design we are focusing on reduce, reuse or recycle.

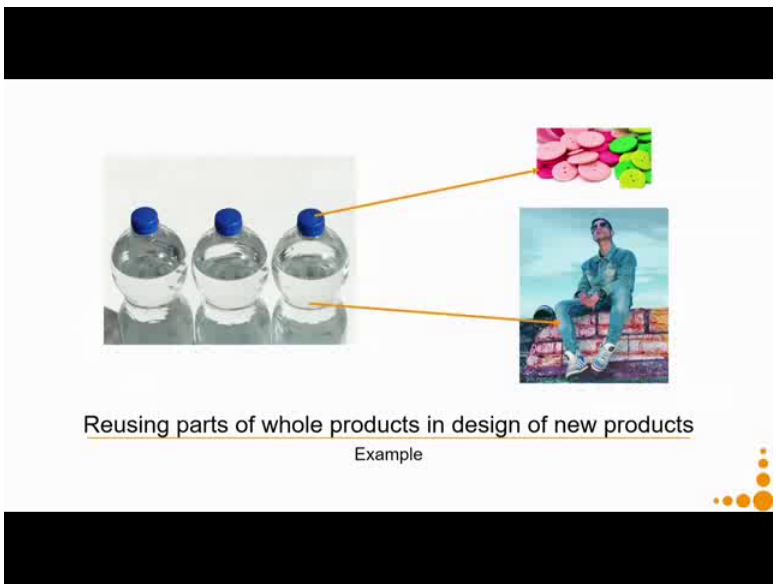
(Refer Slide Time: 04:54)



So, the different approaches can be. So, 1 approach can we reduce the amount of material used in this product. So, I can add additional corrugations to it as a result my bottle becomes more strong.

So, all the shapes that you can see on these bottle all the shapes that you can see on this bottle the things which are coming in and going out on the, the form of the bottle or say this particular the other corrugations and they are added to give strength. So, I can use lesser thickness of the material to get the same level of strength. So, by addition of corrugation I can add strength and then I can reduce the wall thickness of the plastic material used, as a result their volume of plastic use will be reduced.

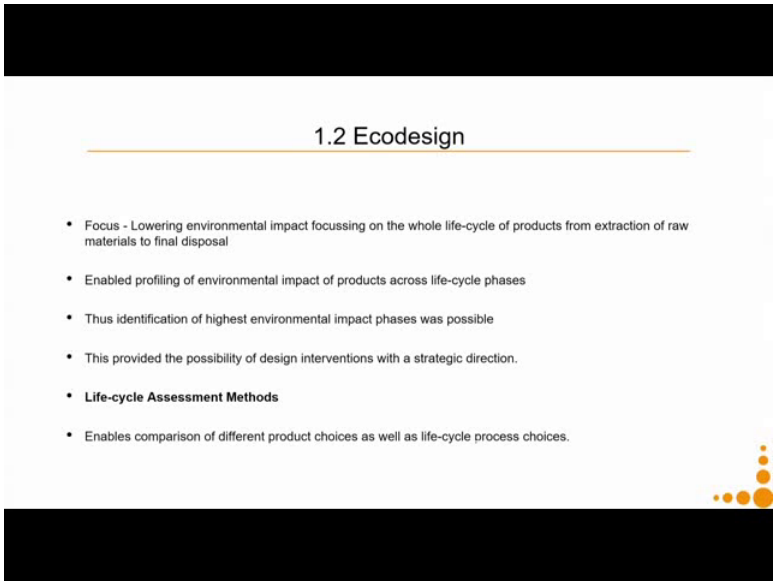
(Refer Slide Time: 05:40)



Or say another concept of Green design is reusing parts of the whole products and design of new products. So, say for example, the pet bottle that can be used for making the denim either trousers or the jacket and the bottle caps they can be reuse to make buttons. It does not solve the problem, but yes if it is if the product can be collected back then it can be converted into theseproducts.

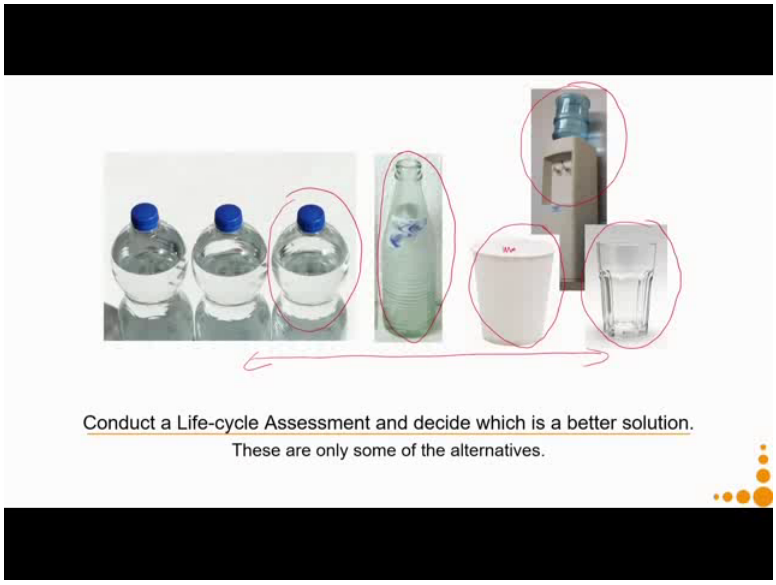
There is lot of problem in the collection, a major part of it is now it is collected, but still big chunk of it ends into landfills or the oceans another trouble is in order to make these alternate products, I need to spend in more energy, more energy, more energy for making the product more energy for cleaning these bottles crushing them processing them and so on.

(Refer Slide Time: 06:41)



Coming to the Eco design concept where we do a life cycle assessment.

(Refer Slide Time: 06:45)

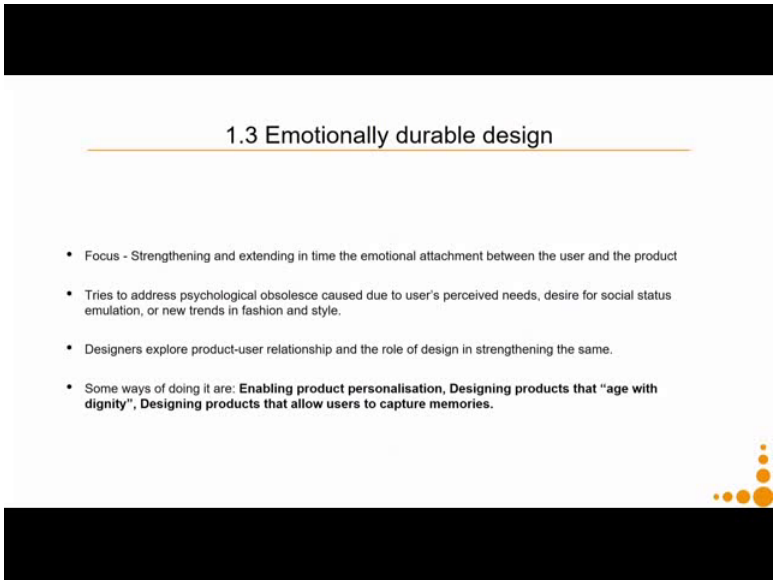


So, say for example, I can drink the same water which I can drink in a plastic bottle by using a glass bottle. So, these glass bottles after drinking water can be thrown in a trashcan and they can be collected, they can be cleaned and again used for another cycle of providing drinking water or I can install a water dispenser and I can keep some paper cups over there. So, these are paper cups with a thin lining of plastic on the inside surface.

So, anybody who wants to drink water they can fill a paper cup drink the water and throw away the paper cups. In this case, the waste that is being generated is the paper cups which are not recyclable because of the plastic layer inside it, another option is I can have glass is made up of glass. So, one can drink water then keep it in a, tray or container on the side and those glasses can be cleaned back and reused.

In this case the troubles might be like the impact which is caused due to the cleaning which is soap and water. So, what the life cycle assessment approach or the eco design approach will try to emphasis is do comparative between all these 4 approaches, you can also take up many more alternative which offers you the same functionality. And then compare which one is the most eco friendly under a given circumstances the next 2 lectures of this week will deal with how to do this.

(Refer Slide Time: 08:29)



Now, comes the emotionally durable design wherein you want to enable the person to get attached to the product and as a result elongate the life of the product which can be done by enabling personalization or designing products that age with dignity a designing products that allow users to capture memories.

(Refer Slide Time: 08:48)

Say for example, I call people for a party to my house for the birthday of my child and I can give every guest who is coming in a glass which something is to on it which helps them to remember the event. So, we love with love from our sweet angel on her first birthday. So, this can be a personalized is this is just an example of 1 way of personalizing, you can also give away the glasses to the guest within small etching

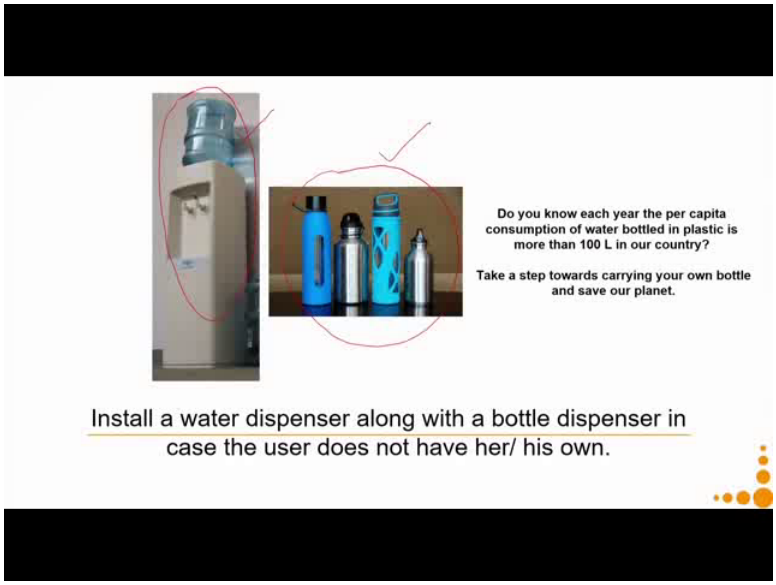
machine and say personalize it here itself and start drinking water and you can carry away the glass with you.

So, in this case I am elongating the life of the glass. So, my guest can carry away this class along with them and keep it as a memory of the event. Next one, design for sustainable behaviour change.

(Refer Slide Time: 09:37)

So, in this case you try to make people adopt as desired sustainable behaviour and abandon an unwanted sustainable behavior.

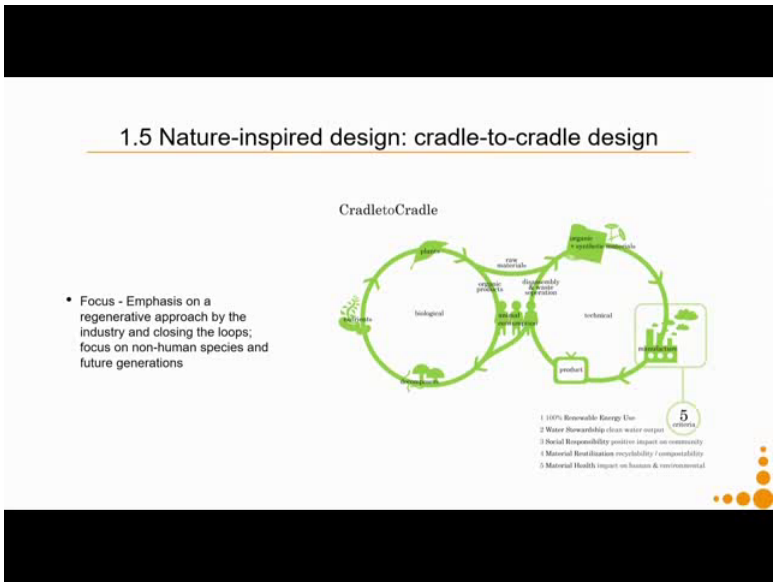
(Refer Slide Time: 09:49)



So, say for example, what we can do is we can install a, water dispenser again because I am using a mineral water bottle or some kind of purified water. So, I am ensuring it is safe drinking water. So, you install the water dispenser you have another dispenser from which one can buy bottles. So, either you carry your own bottles or you can buy a bottle from that dispenser which can be carried along with you for your other upcoming trips.

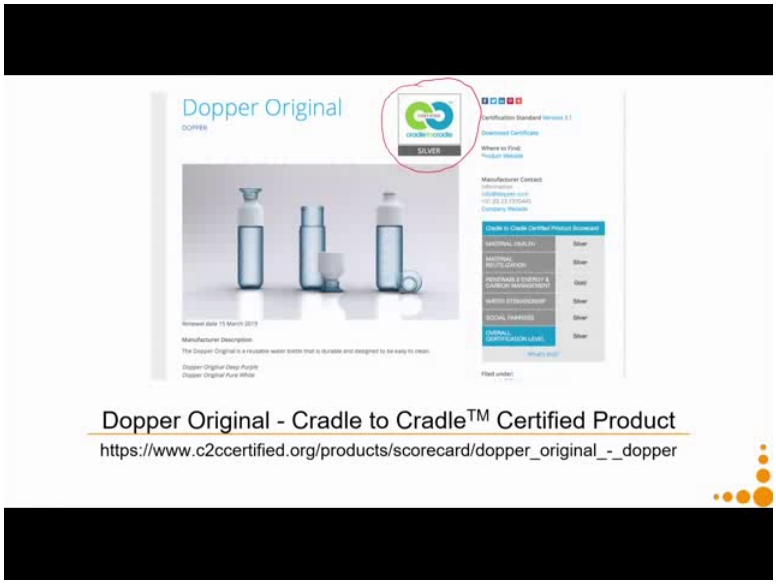
Along with the campaign statement, do you know each year the per capita consumption of water bottled in plastic is more than 100 liter in our country take a step towards carrying your own bottle and save our planet. So, in this particular way we are trying to create certain kind of awareness and people and also enabling them to buy a bottle then and there if they are not carrying one and keep on using it thereafter. So, this can be a concept which is inspired by the design for sustainable behaviour approach.

(Refer Slide Time: 11:01)



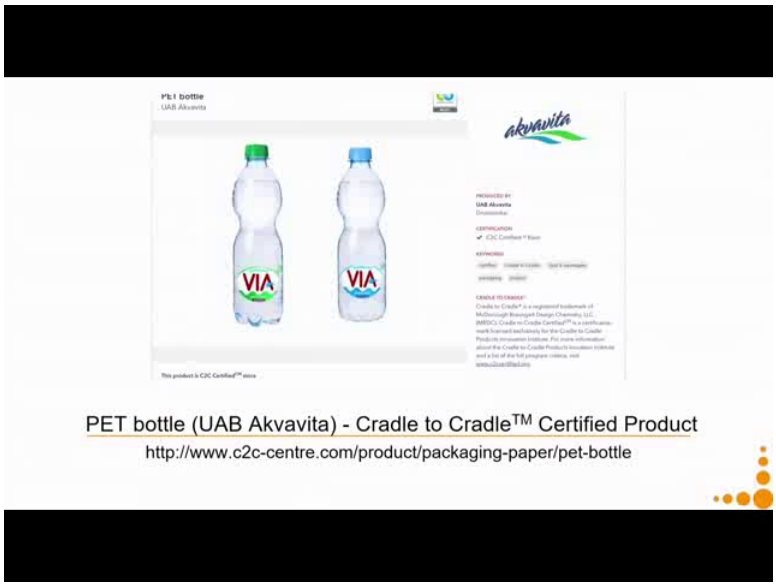
Now, coming to the cradle to cradle design approach.

(Refer Slide Time: 11:03)



So, company called Dopper, they designed the reusable bottle which has been cradle to cradle certified. So, in cradle to cradle certification there are different levels of certification that you can get. So, for their bottle it is again a reusable bottle. For their bottle it has a silver certification, silver level certification. You can go to this website and read more about this bottle.

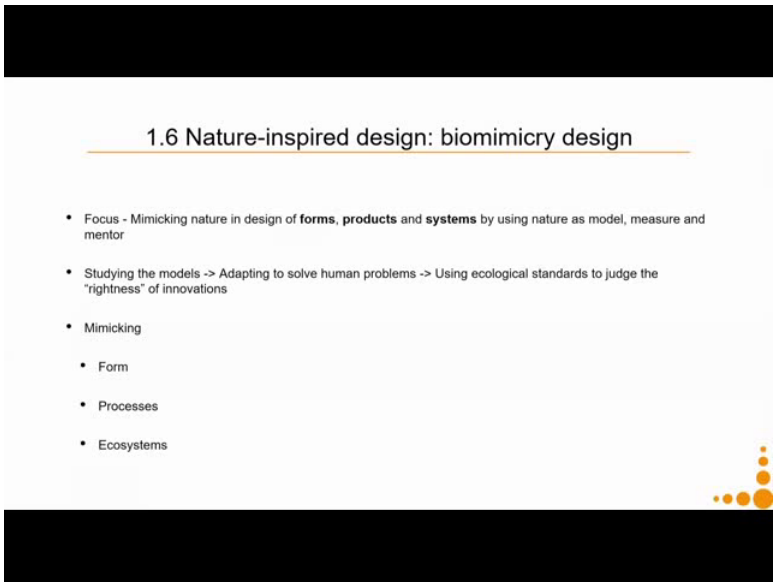
(Refer Slide Time: 11:33)



There is another pet bottle which has been designed by a company called UAB Akvavita and they have also got a Cradle to Cradle certification, their certification is a basic level certification. So, it is again disposable water bottle. So, 1 time use and then you dispose it which made up of pet like the bottle that we started with. And it is cradle to cradle

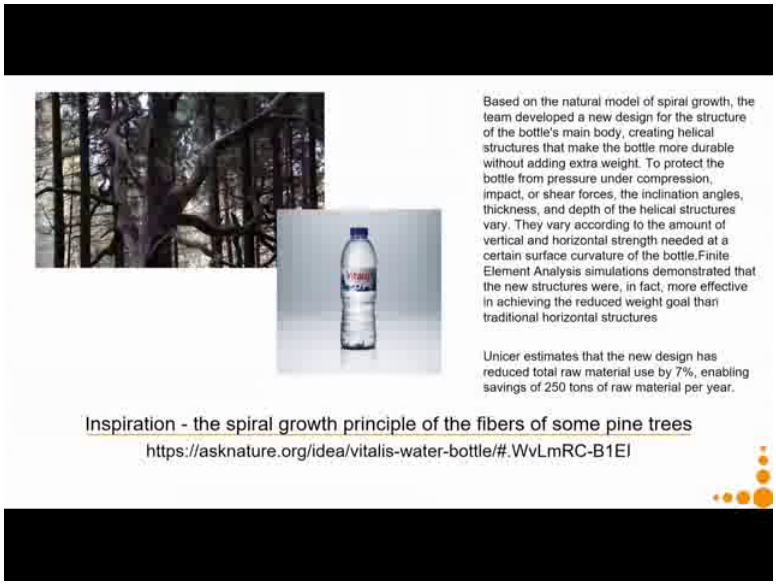
certify, again the problem is one has to take this bottles and put it into the recycling and reuse phase and it does not help in changing behaviour of people towards more sustainable consumption.

(Refer Slide Time: 12:15)



Then comes a nature inspired design of biomimicry design wherein you can mimic in terms of form products and systems.

(Refer Slide Time: 12:21)



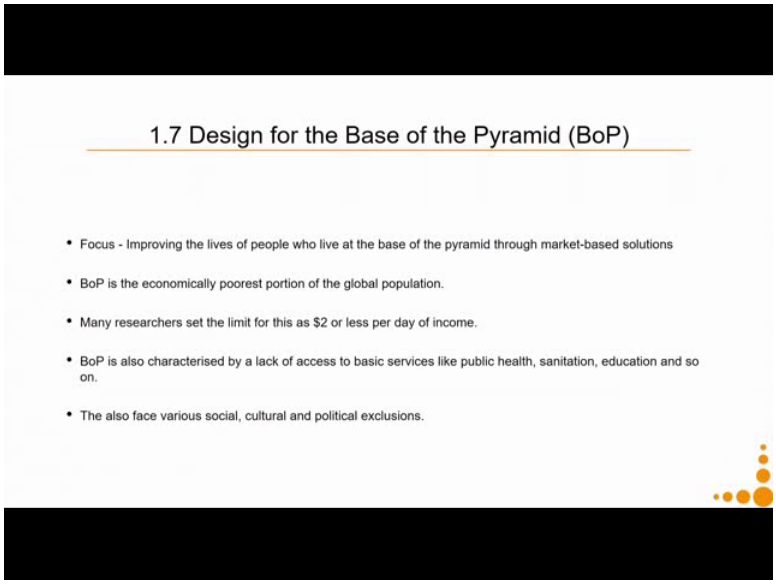
So, like I told you in the first example the green design example that you can produce corrugations in your bottle and as a result, it will help you to strengthen the bottle and

that will can and you can have thinner wall thickness for the plastic material used. So, you use a lesser plastic material.

So, in this particular bottle which has been developed they take in took inspiration from, pine tree. So, they found that to protect the bottle from pressure under compression. So, there are lots of bottles stack together which will be under compression because of the weight of all other bottles on top of them. So, to protect the bottle from pressure under compression impact because it is moving in a truck so, there will be impact or shear forces.

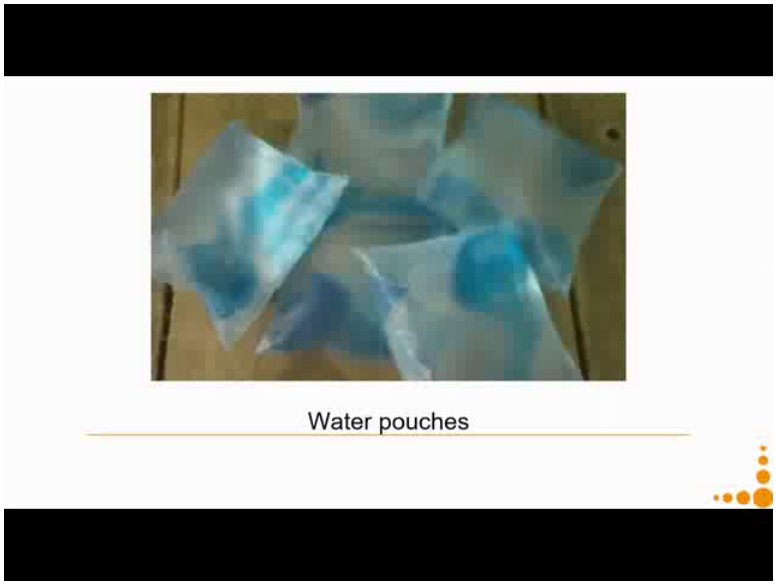
So, when you are trying to open the bottle the inclination angle thickness and depth of the helical structure. So, the there are helical structures over here, they keep on varying, they vary according to the amount of vertical and horizontal strength needed at certain service, surface curvature of the bottle. How was is developed based on a natural model of spiral grow the team developed the new design for the structure of the bottles main body creating helical structures that make the bottle more durable without adding extra weight. So, by doing this Unicer estimates that the new design has reduced total raw material used by 7 person enabling savings of 250 terms of raw material per year. So, again it does not affect people from changing their consumption, they still will consume lot of bottles, but in this particular context each bottles weight is reduced by using biomimicry principles. And you can bring in certain amount of impact the last one which is designed for the base of the pyramid.

(Refer Slide Time: 14:26)



So, we spoke about it that there can be two way to approaches to it approach one is where I consider them as consumers.

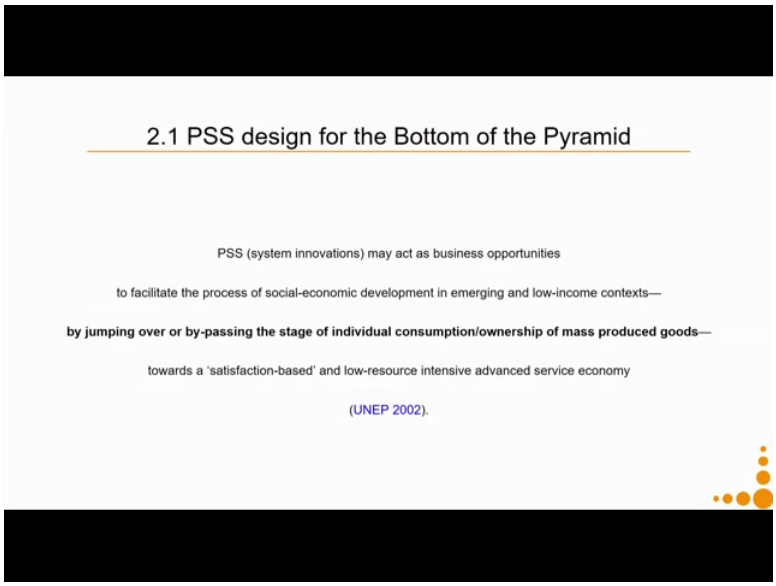
(Refer Slide Time: 14:35)



So, following that particular approach I can sell them smaller pouches of water, these pouches are way much more less expensive than the bottles of the pet bottles of water, but again the it does make clean drinking water accessible to the base of the pyramid. But it and it is also low cost, but these plastic films are a big time waste as well and they cannot be recycled.

Now, coming to the second approach of base of pyramid where we try to understand what is the requirement and then try to fulfill through interesting product service solution. So, now, we go to the next level which is the product service system innovation level.

(Refer Slide Time: 15:18)



So, as we spoke about in this particular level we try to bring in a combination of product and service together which are together able to satisfy a particular unit of satisfaction and it says that you really do not need to encourage individual consumption and ownership of mass produce goods, but if you move towards satisfaction base you can move towards low resource intensive products which is shared by the community.

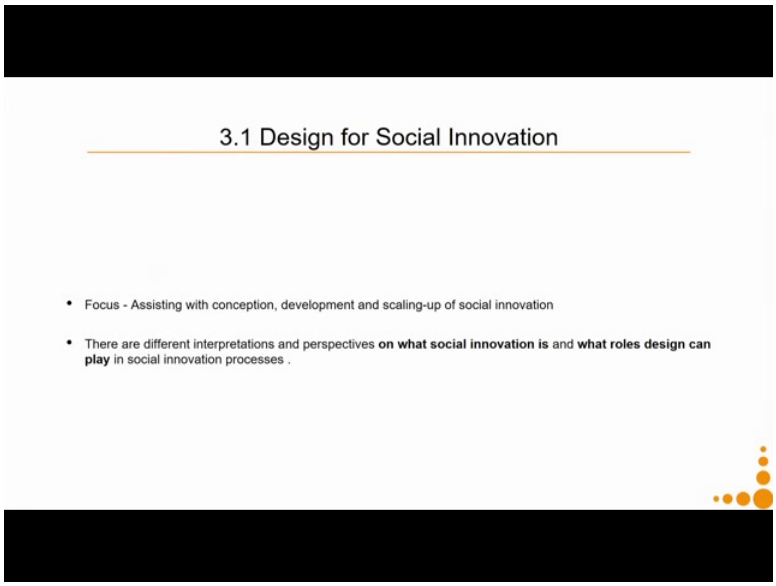
(Refer Slide Time: 15:51)

So, this was the example that I give you in the previous class as well. So, this is our water dispenser you can carry your own bottle. So, mostly the people will carry their own bottles or containers and per use you can pay for the water. So, this is the approach which we can take for giving clean drinking water to people in the base of the pyramid, but not necessarily base of the pyramid this approach can is a very frugal and effective approach this can be set up in many different locations for in example in public places in railway stations in government offices in institutions and so on.

Now, coming to the third level; before going to the third level the benefit of the second of the solution is also that I do not have ways in terms of bottles of water in terms of the bottle which is plastic or in terms of the paper cups which is again paper plus plastic which needs to go through a recycling phase or which need go into the land phase. Here everybody is carrying their own bottle because that is more economical to do that and it gets into the behavior, slowly that one has to carry their own bottle and then one can pay and drink water. And at the same time the providers of the service because they charge say 2 rupees per liter of water, they know that more efficiently they can run this machine with the least amount of wastages with the least amount of impact on the environment with the least amount of energy to be consumed.

It is in the economical interest to go towards environmental sustainability as well as social sustainable the socio ethical sustainability coming to the third level which is the spatio social innovation level.

(Refer Slide Time: 18:01)



What it talks about is assisting with conception development and scaling of a social innovation. If you remember from the last lecture what it was talking about is a major focus is on social innovation and we use the existing assets, assets in terms of technological assets knowledge assets or physical assets like roads or conditions of that particular place of use the existing assets to conceptualize develop and scale up social innovation.

Not much innovation happens in this particular context in terms of technology, there was also, we also saw that there are different interpretations on perspectives on social innovation and what roles design can play in the social innovations.

So, social innovation can mean well being of people, can mean providing people with their basic amenities like nutrition drinking water roads and so on it can also imply harmony and so on. So, there can be many interpretations of what social innovation is, but wherever it is connected to the communities, it is about social innovation. So, I will show you one particular example.

(Refer Slide Time: 19:22)

This example is how people are trying to revive the rain fed rivers. So, not much technology is used we are using our existing assets and knowledge and by mobilizing, people mobilizing organizations and through them mobilizing economic resources, 1 is trying to revive the rivers, the model is scale or is also scalable, it has already means scaled to some 14 rivers in India. So, we will go through this of lecture [FL].

Today I am going to speak about one of the most important source of our existence next to oxygen, water I see 100s of people sitting here in the auditorium or I can say 70 percent of this auditorium is filled with water.

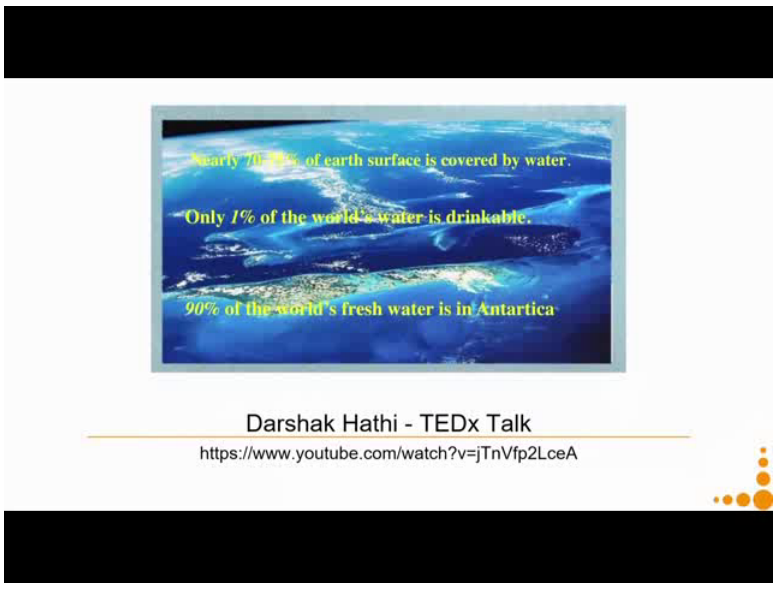
(Refer Slide Time: 20:44)

Yeah because 70 percent of our water our body is water.

(Refer Slide Time: 20:47)

Our bones our skin, our muscles everything is made of water is not it amazing, everything is what we see is just a water. There is so much of water in the world, we see a waterfall, oceans, huge lakes, reservoir, sometime we just wonder that why there is scarcity of water. Anyone thought about that, I tell you something very interesting. Let us say if we put all the water in the world in this bottled how much do you thing is a drinkable water any guess? Yes, this much, nice.

(Refer Slide Time: 21:43)

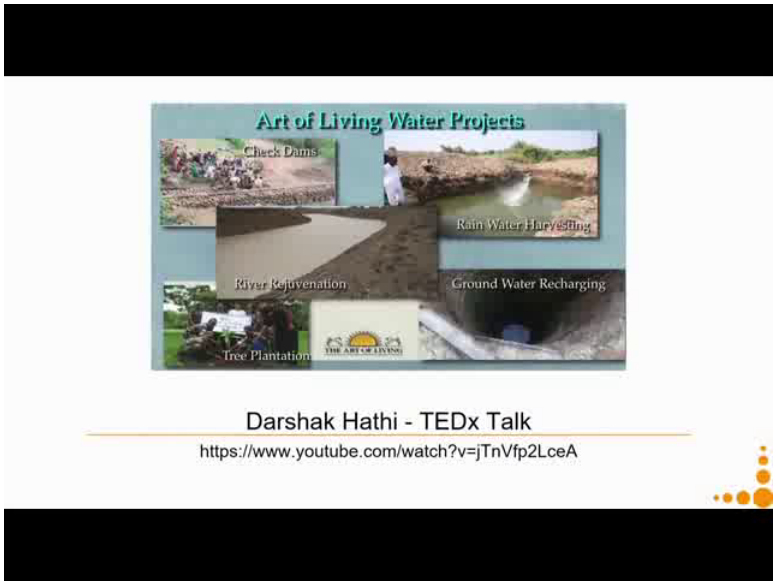


Though there is a 70 to 75 percent water on the earth surface, only 1 percent is a drinkable water and out of that 90 percent is an Antartica. To the other day ours discussing with one of my friend, we ask the very powerful question is a Mister Hathi, what is your point? Is it a scarcity of water or peoples relationship with the water? Why really started thinking about that? And ladies and gentleman, you are right. More important is our relationship with the water, any of wonder what is your relationship with the water nearly 3000 farmers are migrating from the of rural areas to the urban areas every day in the India.

Other livelihood and because of scarcity of water, my previous speaker spoke about open defecation, government is trying hard to give a toilets in each and every home this is last.

So, many years, but they failed because the scarcity of water farmers are committing suicide, you must have heard about that. One of the reason for farmer suicide is scarcity of water, our government says the whole ratio between the urban and rural area has changed, it worth's it used to be 30 to 70 percent. Now, it is 45 to 55 percent which is also creating a problem in the urban area. Understanding this know that why water is so important, the art of living this class so, many years doing several projects on the conservation of water.

(Refer Slide Time: 23:19)



We have made the check dams, rain water harvesting, recharging the ground water, we just very important rejuvenated the river. Our traditional river based to have rivers in all

over the countries, but which is not rejuvenated since so many years. Replantation also which is very important aspect, but today I am going to share a very beautiful story of transmission with you.

(Refer Slide Time: 23:46)

This is the arena river in the Latur district of Maharashtra.

(Refer Slide Time: 23:51)

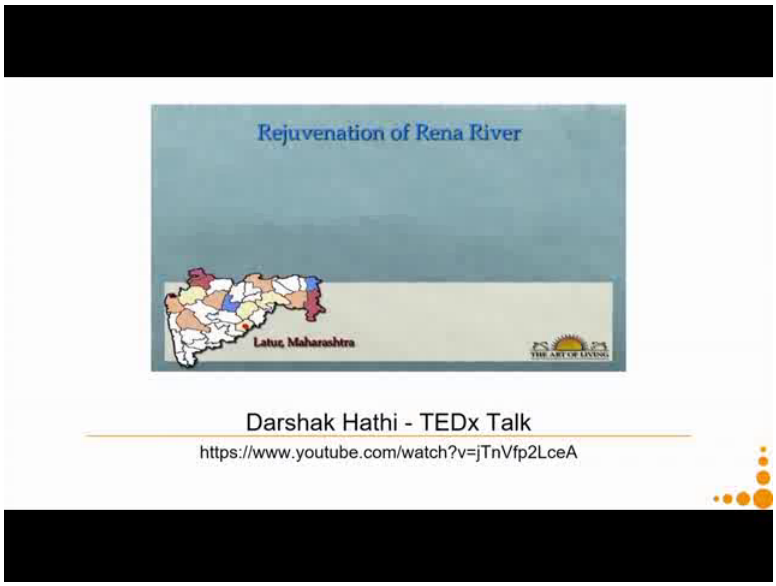
And man behind the story Makrand Dave or is other name is Makrand Jadav, he is a civil engineer by profession, based from the farmer family is also an art of living trainer and

his area from where is coming the Latur district since last. So, many year that area is brought effected.

So, he is seen that scarcity and struggle for the water from the childhood. No, he is to share that when I was to see my mother, why you know, walking kilometers together just to fetcher 2 bucket full of water was so painful, yeah [FL].

Now he was always looking for a solution that what is the solution. Now why there is so much of scarcity of the water and after he became trainer he started you know conducting the workshop in a different areas in the villages started interacting with the people. Slowly he could understand the gravity of the problem and then he decided go I must do something about this I need to create a model. You know sustainable model which can inspire so many other people.

(Refer Slide Time: 25:07)



So, he took it, has a challenge, he selected a river Rena river which is in the Renapur village and the population of that village is around 20000. So, initially he face lot of challenges, one of the biggest challenge was people were very apathetic to the issue, they were expecting the government the local administration to take care of that issue. Why should I take the responsibility? It is lot, my responsibility you know and alcohol is them was one of the biggest issue in that late back attitude of the youth. I do you want anything you know I am getting everything and I am getting all the free bees from the

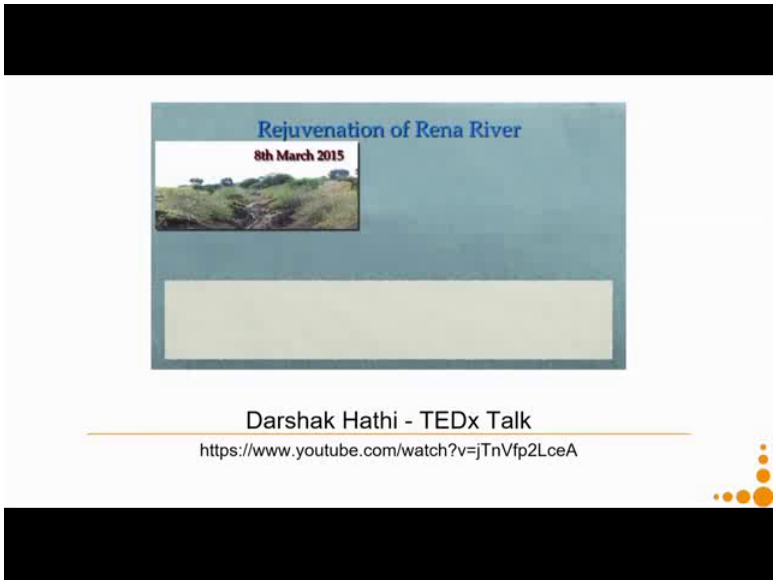
government. Why should I do anything and then there is lot of groupism, other basis of cast and religion, you know political groups.

So, to overcome all these challenges, you know he targeted the youth and he conducted the, organize one work shop call youth leadership training program which is the most powerful workshop of the art of doing foundation. It is a 8 is very intense training program for the youth which really help them to transform their mindset, their behavior, their attitudes, the relationship with the people and you know the society. So, that made this is youth know he train 50 youth a change agent for the society and through them he slowly started mobilizing the society. You know bringing people together I telling something very interesting, you know in religious you have this Gram Sabha probably you have heard about it.

The Grama Sabha is exactly model of parliament in the village. So, unless the Grama Sabha pass the resolution that they do they want to do something in that particular bridge. You cannot do anything and that was the village of 20000 people.

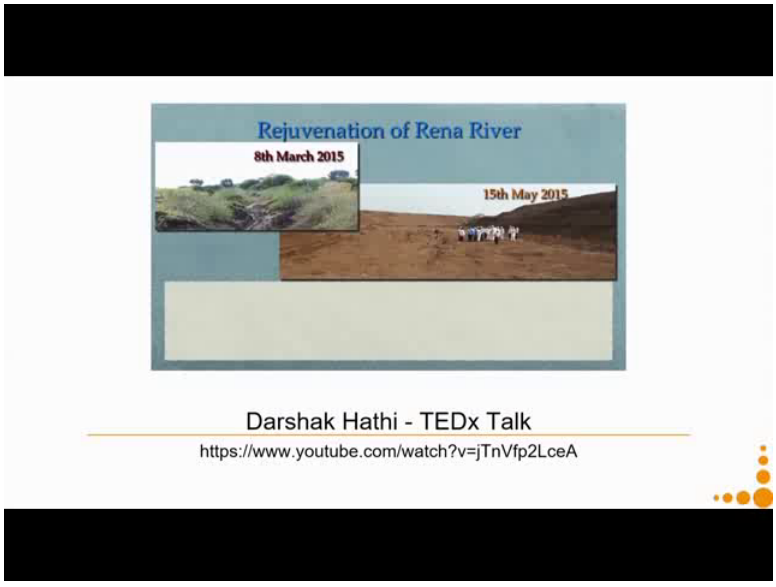
So, it really took him some time to bring this people together and you know big a decision. Yes, we want to revive this river and not only reviving is ahead people through this youth to contribute for the same, you know that changing the mind set oh the government administration. No, it is my response, no never heard of challenge is, but I said that [FL]. So, his constant you know perseverance to do something as made a change.

(Refer Slide Time: 27:44)



Let me tell you let me take you through the journey of this transmission, this is the Rena river on the 8 of March 2015, with I should really call it a river is a question you know.

(Refer Slide Time: 28:01)



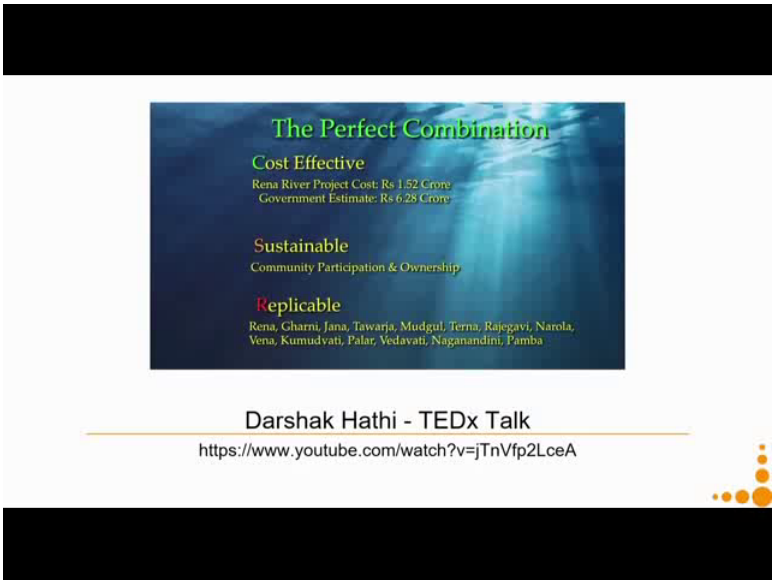
So, on the 8 of March it was like this and it took almost 90 days of hard work. You know to deepen the river, widen the river and clear the entire stretch. So, it was a 4000 metes long, 25 meter wide and 7 meter deep 90 days and the removed 12 like 60000 cubic meters of celled from that. You know celled is like, black salt I mean the black soil, you know which you can use as a manner is very - very fertile that the farmers that took away all that soil and put it into their farms 12000, 12 like 60000 cubic meter. So, once that entire batch was clear Tejas has to wait for rain fall and here you have.

(Refer Slide Time: 28:52)

In the first rain fall itself the entire river was filled with a fresh water. 126 crore liter of water was stored and not only that 4 time more, but buck lighted in the ground 4 time more, that is almost 500 crore. If you take sometime over a period of next 3 month and if I give this figure, my earlier speaker was speaking about that. You know on an average the urban people need about 135 liters of water, but they do not get it in the village. It is very different they need only 55 liters of water per day they use or they consume.

So, village of 20000 people in a year, they consumer only 40 crore liters of water and we have stored 126 crore of liter in just 3 months time. That is the number you know, if you decode that 126 crore, you know later and 2000 acres of land got irrigated. Hey, I think we need we deserve a the big round of applauds from you which will also help you to the little more enthusiastic in this afternoon. So, you know ladies and gentleman many time people asks like how do you measure the effectiveness of the any project. For often say the first thing is people ask this question, is it a cost effective?

(Refer Slide Time: 30:15)



Now, if I show you the figure government estimate was 6.28 crore for that river rejuvenation and we did that only in 150 core to cores and out of that 75 percent was contributed by the community and rest of the money 25 percent was given by the art of doing foundation sustainability to when communities doing something there is the sense of ownership, I have done it and I have to maintain it.

So, it is the most sustainable model that we had you know, you do not have to worry about it oh that you know why again next your, we need to re sale that thing and maintain a there is a, here it is. Now our baby we will take care of it, do not worry about that.

Sustainability and replicable so, this is not the only river. In India we have rewire more than 14 rivers in Karnataka, in Kerala, in Maharashtra, in Andhra Pradesh, pamba probability. Many of you know about Shabarimalai this river is connected to Shabarimalai, know it was very dirty, our people went and you know river, the entire river with inspiring yes I able to define your relationship with the water. Yes, no how can you help? You know [FL], but behind I would say though who like to see the dream, but then the night is too short, but those who like to full fill it, but then the day is too short and I feel that all of us need to be a dreamer.

Bring it to see the big dream about our community, about our country, about our world and how can we make it a better place for our next generation, come. We got it the we are not, we have not inherited this, we have borrowed it from our next generation the

when we leave this planet we need to make it little more better then how we got it, right, save water save life.

So, what kind of difference do you see in this approach. So, when we were talking at the product innovation level, we were only thinking of the problem of delivering water to people, drinkable water to people during events and how do I package that water. How do I package it more environmentally friendly or less environmentally damaging in a damaging manner. As soon as we went into the product service innovation level we were trying to give it a different approach all together, we were thinking it is not like I have to reach 200 ml of packaged water to people, it is like what is the unit of satisfaction. The unit of satisfaction is not 200 ml of packaged water in a plastic bottle or a glass bottle or so on the unit of satisfaction is clean drinking water.

So, this can be given by a combination of a product as well as the service. Now as soon as we get into the third level which is the special social level per view expand further in a particular special condition like the example that you saw in the video, it is a place where rain falls are happening in say 3 months in a year the rivers are rainfed rivers.

So, they collect water and that is the only source of water for the rest of the year, the people living in the rural area. So, they have to travel a long distances to get water. So, that is this characteristics of the space of the geography of that region and people and living under certain circumstances, there agriculture production is a way much lower because of lack of water you cannot irrigate your feels.

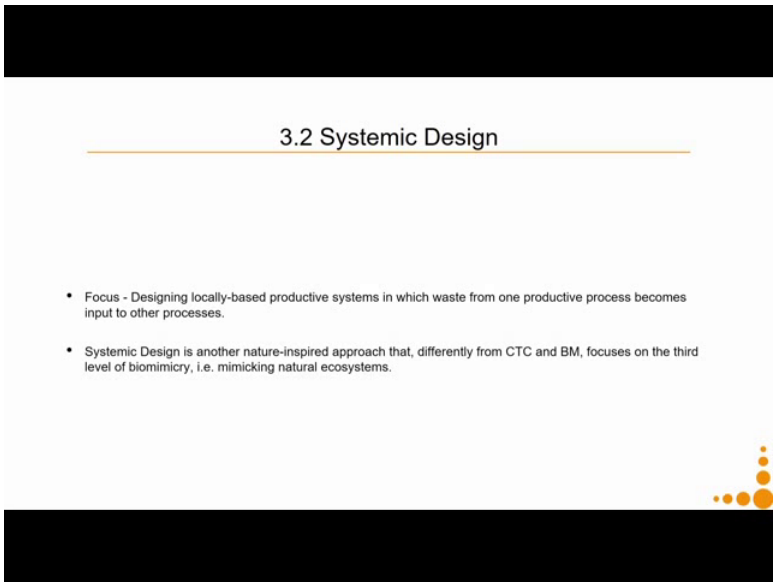
It is completely depend on, on monsoon which means you might only be able to read 1 crop in a year. Now when people come together there is not much technological innovation that has happen, but it is like social innovation, people across many villages, came together, organizations where form art of living along with government initiatives and so on they came together. They formulated a particular system for cooperating with each other, expanded the river dug of the river. There sell that they are getting that is also very useful for them because the people who are doing the take it back to their forms and they are getting very healthy soil for growing there crafts and they could solve their water problem.

So, the perspective with which here looking at the problem keeps on changing from level 1 to level 2 to level 3, our problem becomes more expanded when this. So, as our

speaker mister Dashak heartily explain to you it is also a sustainable model because the people in the villages, came together to take care of their river.

So, the chances that they will keep on doing it year after year and keep on reaping the benefits is very high which means social and economic sustainability of that component which will bring in eventually environmental sustainability and it has also been replicated over 14 different rivers.

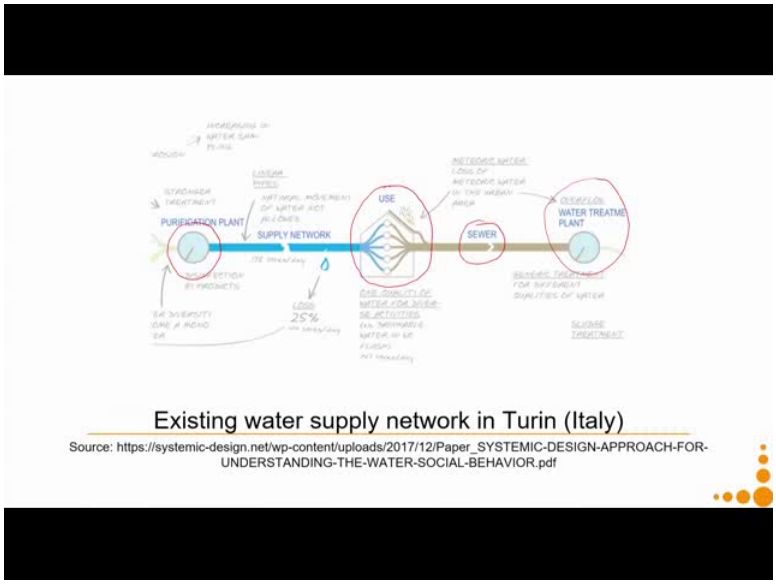
(Refer Slide Time: 36:11)



Another approach in spatial social is the systemic design where our focus is on designing locally base productive systems in which the waste from one productive process becomes input to the other process.

As we discussed in the last class in Cradle to Cradle or biomimicry we are, our focus is on the nature inspired forms and processes, but in systemic design our focus is on the third level of biomimicry that is may making natural ecosystems.

(Refer Slide Time: 36:47)

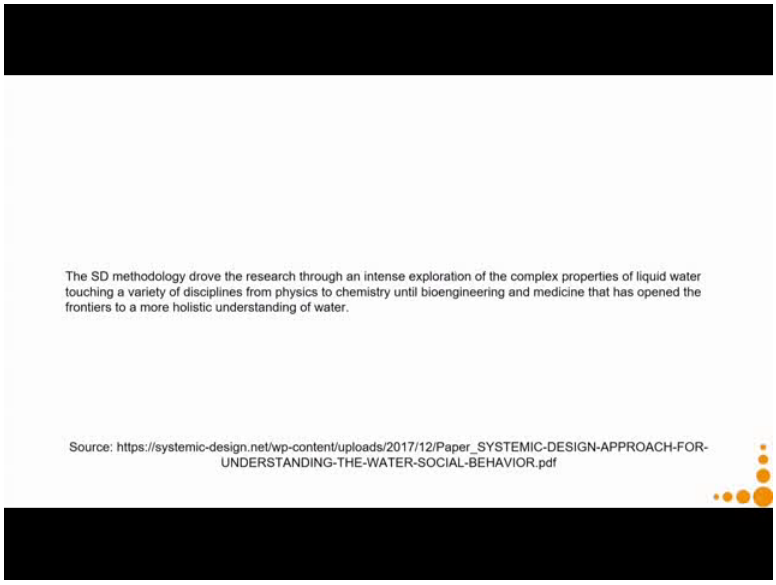


So, I will show you 1 example of work which has been done by a technical university of Turin in Italy. So, first they tried to map the existing water supply network in Turing, you can read more about this particular project in the source paper mention and see how the systemic design approach has been developed.

So, what was observed that there is a purification plant which purifies all the water through the supply network it is supply to the city and drinkable water. So, the water is purified up to the level that it becomes drinking water is used for different kinds of purposes. So, it is drinkable water which you flush in your toilets is drinkable water which is used for bathing is drinkable water which you have using for washing your car or for watering your lawn. So, not drinkable water is not required for doing all these activities and always water then goes down the sewer which is the same line irrespective of the level of contamination in the water it all goes into the same line which is the sewer line and goes for water treatment.

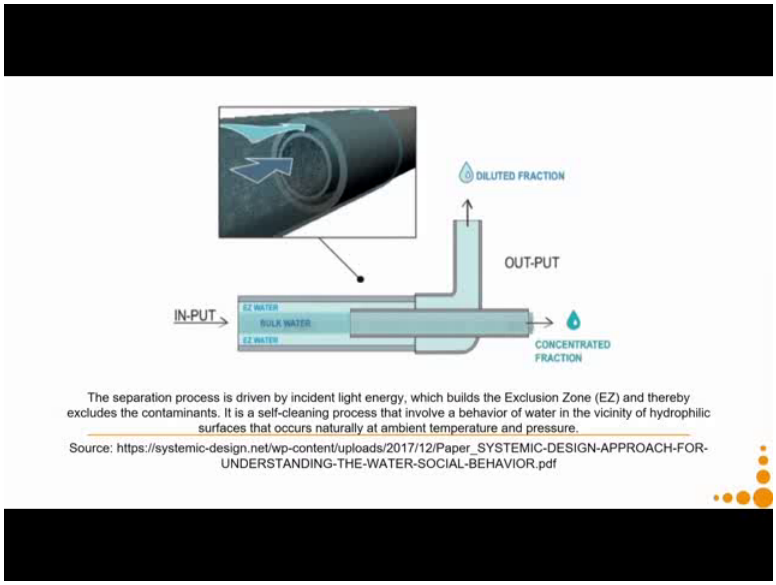
So, water waste of precious resources. So, they try to come up with an alternative by trying to do a systemic design where in they have to understand the how to get inspired from the nature at the ecosystem level, where waste from 1 process can become an input to the other process.

(Refer Slide Time: 38:22)



So, the systemic design methodology drove the research through the research team through and intense exploration of the complex properties of liquid water touching a variety of disciplines from physics to chemistry until bio engineering and medicine that has open the frontiers to a more holistic understanding of water in systemic design. You require a teach with a large variety of expertise who can bring in the knowledge from as many as possible for a particular context. So, they came up with certain kinds of solution.

(Refer Slide Time: 39:03)

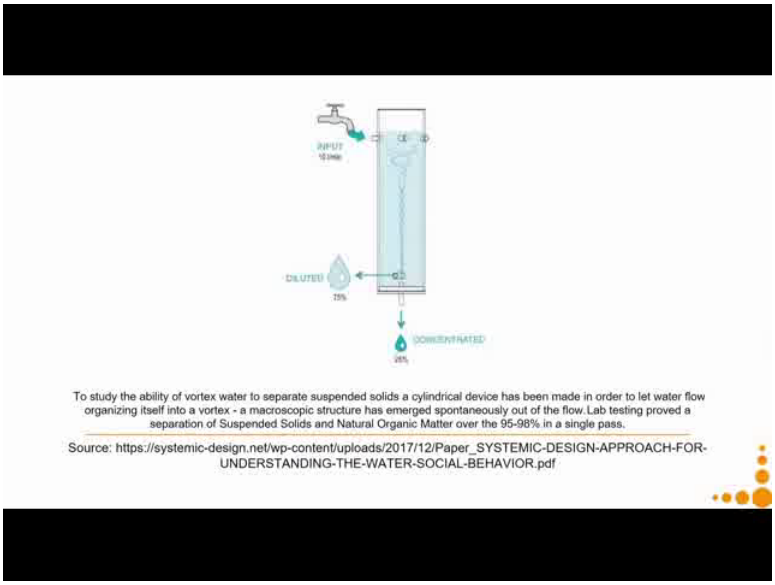


You, I am not going into the depth of the solutions because they belong they come from particular discipline. So, it might be easy for people to understand, if they belong to that

discipline, if they do not belong to the discipline, it the solution might not be very easy to understand, if you are interested in reading more about it you can go through the source material I have mentioned.

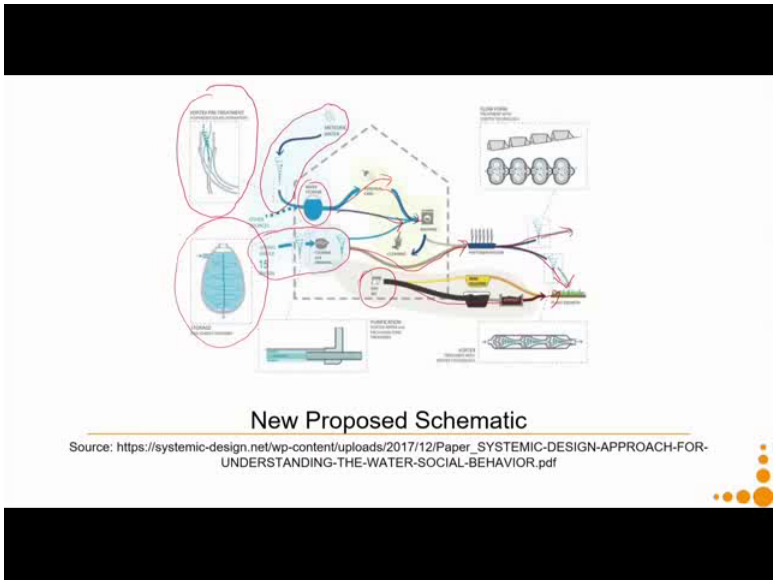
So, they came up with two different ways of water purification, the first one they called as exclusion zone in which the separation process is driven by incident light energy which builds the exclusion zone and thereby excludes the contaminants. It is a self cleaning process that involve or behavior of water in the vicinity of hydrophilic surfaces. So, hydrophilic surface is a surface which he loves water that occur naturally at ambient temperatures and pressure.

(Refer Slide Time: 40:02)



The next process, that they use towards the vortex process which we already discussed in one of our previous lectures. So, study the ability of vortex water to separate suspended solids a cylindrical device has been made in order to let water flow, organizing itself into a vortex microscopic structure has emerge spontaneously out of the flow. Lab testing proved separation of suspended solids and natural organic matter over by 95 to 98 percent in a single pass that is when water pass through it only ones.

(Refer Slide Time: 40:43)



So, now they came with a development of a propose schematic for the city. So, here you can see vortex pre treatment water is being, pretreated by using vortex in this case. So, you have water coming from say rain water or any other source then it goes to storage tank which can be used for personal use, it can also be used for washing,. After it has been taken through a personal usage care it can be again purified for suspended solid matter to be used in a washing machine which is possible or it, this water storage can directly be used for washing clothes.

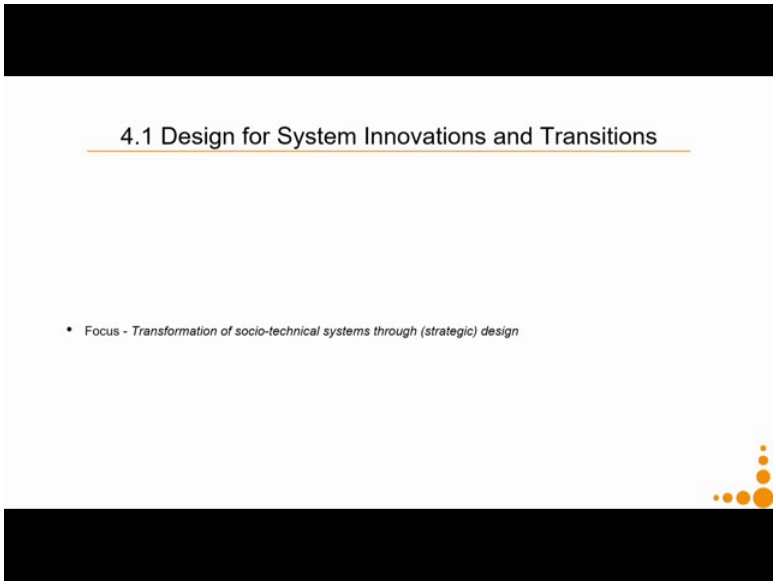
Another system is the storage it is the X shape container from here you get spring water which you can use for cooking and drinking this water, the waste coming from here can be actually used for gardening purposes or it can be taken through the 5 to de purification process. So, it goes to the garden or it goes for, for the usage.

You can also use the waste water for your toilets which can go through a better cleaning process because the water which is flashing out of a toilet a contains much higher degree of pathogens and then it can be also supplied into the garden of a plant growth. So, they proposed a new schematic which uses different sources of water as well as different purification systems and the waste water from 1 particular process can be used in another process or the waste from 1 waste from 1 particular process can be purified using certain process to a certain degree to be used in another process which does not require drinking water level purification.

Again in this particular model as a pointed out while talking about the limitations of this model, we are not trying to minimize on consumption of water, you used as much water as you want that is what the system means. But the water treatment process has been developed in a way the ecosystem works the same problem comes. If I do not reduce my water consumption then I will build up the concentration of say either, pollutants to a high degree or I am using energy in certain processes. So, will be consuming too much of energy. So, that is the limitation of this process, but if this could be used in a say in combination with the technique and consumption of water by the user is also reduced it can give a better mood holistic picture.

Now, coming to the fourth level, which is the socio technical system innovation level. So, here in this case you have both social innovation as well as technical innovation and both of them are put together in a system and together help to achieve sustainability.

(Refer Slide Time: 44:02)



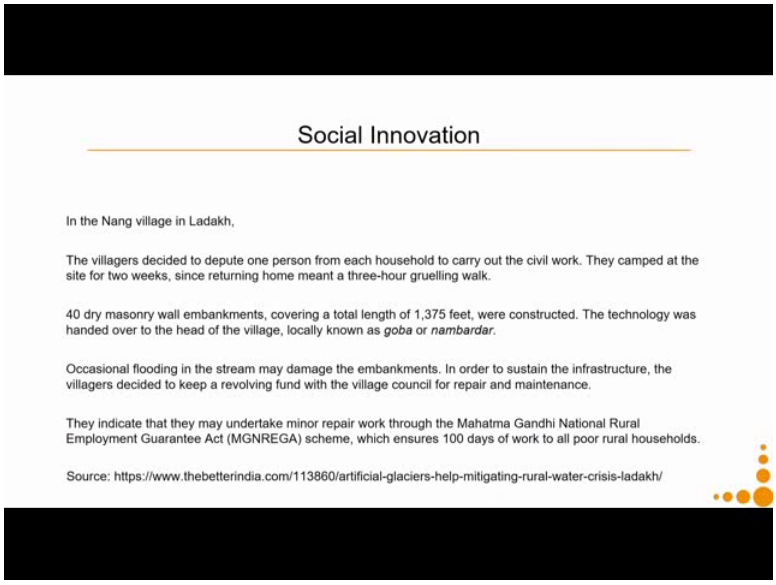
So, here the focus is on transformation of socio technical systems through strategic design.

(Refer Slide Time: 44:05)

So, Chewang Norphel is a civil engineer from Ladakh. So, if you know Ladakh is in the northernmost part of our country and it is a very cold place and it is very high altitude. He notice that a small stream had frozen solid under the shade of a group of popular trees though it followed free flowed freely elsewhere in his yard. At that point of time he realize because the when water is moving too quickly that is what is happening in the river it does not get the opportunity to freeze.

Whereas when the water was struck trickling down sluggishly from the poplar tree it did get the time to freeze. So, based on this he created artificial glaciers here, but diverting a river into a valley slowing stream by constructing checks, the artificial glaciers increase the groundwater recharge during summer when it starts melting because its melting slowly. It originates the spring and providing water for irrigation he constructed them at lower elevation so, that they melt earlier expanding the growing season. So, this artificial glacier, he first time built in 1987. Now when so this is technical innovation that has been done. Now he took it to varies villages where this can be used.

(Refer Slide Time: 45:44)



So, this is case from 1 of the villages it is a Nang village in Ladakh area. So, villages decided to depute one person from each household to carry out the civil work.

The camped that the side for 2 weeks, since returning home meant a 3 hour grueling work 40 dry masonry wall embankments covering a total length of 1375 feet were constructed, the technology was handed over to the head of the village locally called as the Goba or Nambandar. So, occasionally flooding in the stream will also happen and that will damage the embankments. So, the villages would have to sustain this development as well. So, in order to sustain the infrastructure the villages decided to keep a revolving fund with the village council for the repair and maintenance they indicate that the.

So, you might also know that our government has scheme called Mahatma Gandhi National Rural Employment Guarantee Act which ensure 100 days of work to all poor rural households.

So, they this in decided that major repair work or minor repair work, they can also be undertaken through this particular scheme. So, wherein, they can do the repair work or they can do the repair work or relate some related work into it and the people who are involved in it can be paid by this particular government's scheme.

So, then this has been replicated to many other villages. So, this is the social innovation where villagers come together arrangement for the finances is happening through

contribution from the villagers contribution from other sources were also brought in along with combining the existing government schemes into the picture.

(Refer Slide Time: 47:45)

Further technical innovation has happened in 2014 Sonam Wangchuk improve the water harvesting design created by Chewang Norphel. So, Norphes design of constructing glaciers could be implemented only in areas which face north. So, that they give limited sons and despite being in shape whereas, Wangchuks version does not have this restriction and can be installed, even at lower altitudes, also his design of building conical ice structure uses minimum surface area with maximum volume this also prevents spring sun and when from melting the ice.

So, this design gives an edge over the previous one another big edge that is there is its maintenance is not as labour intensive as the north face version was. So, according to Wangchuk you need just one person to maintain this. So, once constructed you need just one person to maintain this.

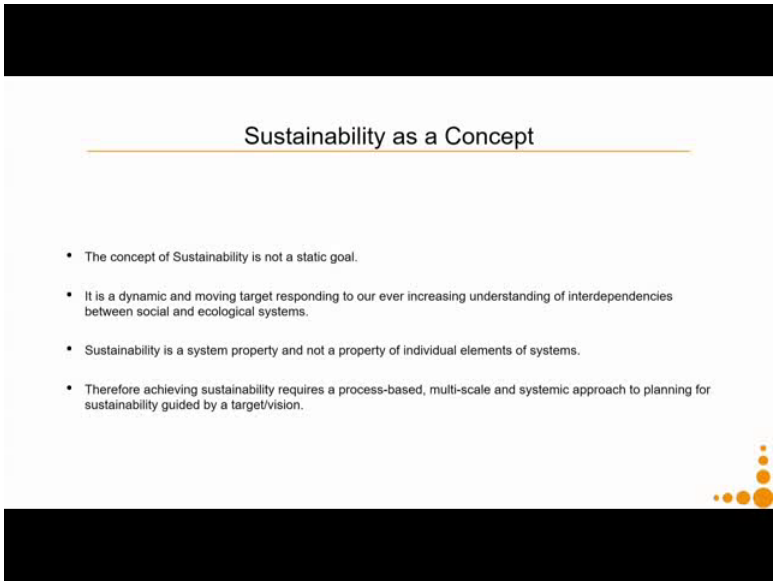
So, let us see how this let us development creates new influx of social innovation along with it. So, that this can spread further and wider on that particular region, you can see that this solution is very specific to the geographic location because of the conditions of the geography of that region. It is very suitable solution it there is technical innovation involved and there social innovation involved where in people come together to form groups, institutions like government schemes or local district officers come together to

form the social innovation part of it and together they achieve sustainable sources of not only drinking water, but water for the agricultural purposes and so on.

So, let us summarize what waited today. So, we discussed on the product innovation level product service system innovation level. So, a special social innovation level and socio technical system innovation level one particular example.

You can try your hands on taking another example and think how do you use it in all these different levels what can be your approach. So, I will repeat the summary that we did in the last lecture, why I am repeating it because now since we took 1 example and took the entire journey you might be better able to appreciate the beauty of the sustainability as a concept.

(Refer Slide Time: 50:28)



So, the concept of sustainabilities not a static goal my initial goal was. Let me give people 200 ml of water, it kept on evolving what happens with 200 ml of water you just can there context, when you can of cant afforded there are context when it. So, if in Ladakh we try to reach two many of 200 ml water bottles I would be creating such a huge environmental degradation over there whereas, that region is the place where most of our glaciers originate from an they give us all the water.

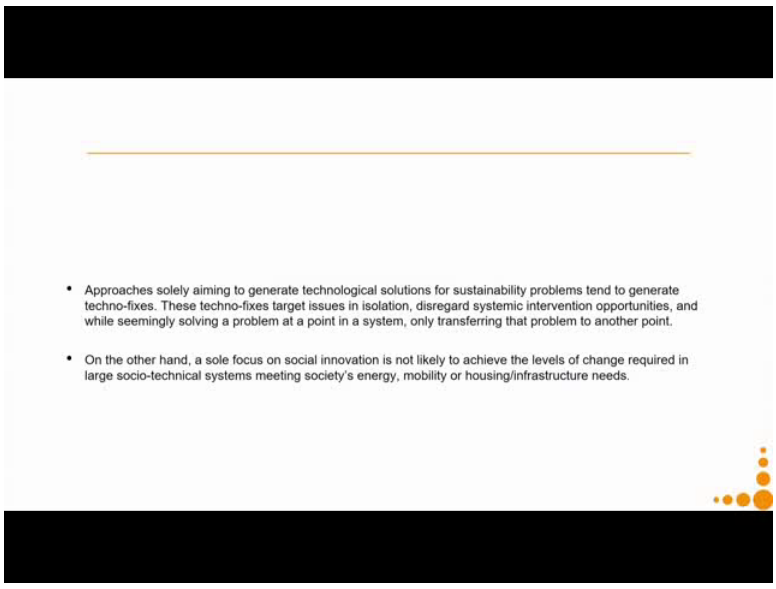
So, the concept of sustainability is not a static goal it is dynamic and it keeps on moving, its target responding to our in ever increasing understanding of interdependence between social and ecological system.

The video that you saw from the example of rejuvenating river, that clearly helps you in understanding that since the understanding of interdependence between social and economical systems improved. Now we know that sustainability does not come by bringing in changes in the medium of packages, but at from my static goal it converted into a more and more and more dynamic goal as a kept on going ahead from one level to another.

So, and also sustainability is the system property, it is not a property of individual element of the system. If we just change the bottle that is not going to bring and sustainability, because it is just an individual element of the system. Therefore, achieving sustainability requires a process paste multi scale systematic approach to planning for sustainability guided by a target or vision.

So, you could so, see the target or vision becoming bigger and bigger from level 2 to level 3 to level 4.

(Refer Slide Time: 52:21)

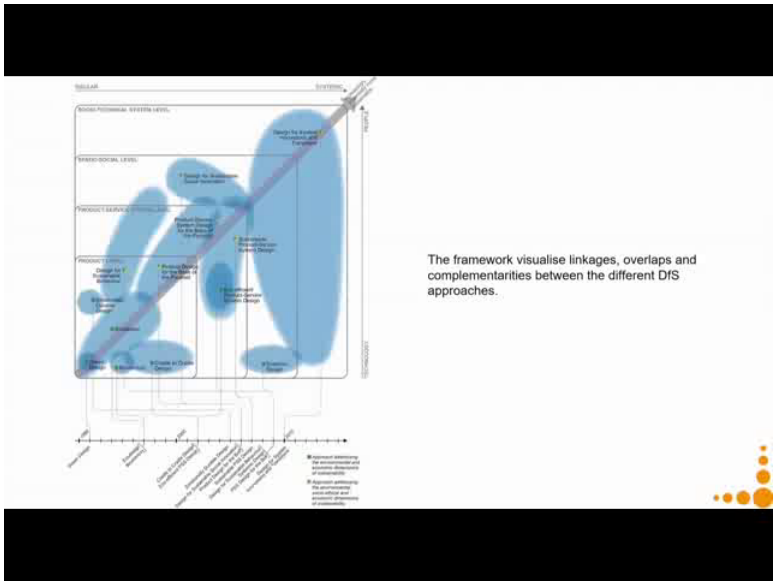


Approaches solely aiming to generate technological solutions for sustainability problems tend to generate techno fixes, these techno fixes target issues in isolation disregard

systemic intervention opportunities and while seemingly solving a problem at a point in a system only transfer that problem to another point. What happens to the denim when you no longer want to use the jacket or the trousers there is no answer to that there is no recycling for that.

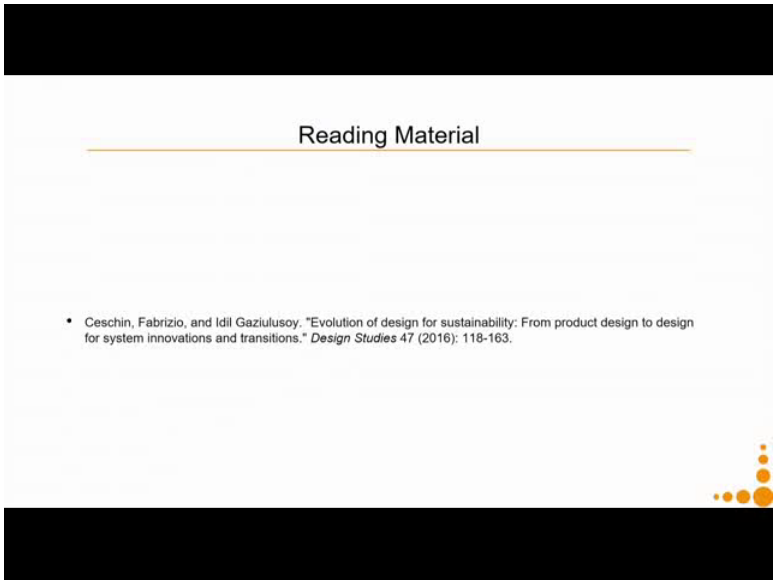
So, I just transfer the problem of the pet bottles from point A in time to point B in time and I have no solution for point B. So, techno fixes has that limitation, on the other hand a sole focus on social innovation is not likely to achieve the levels of change required in last socio technical systems, meeting societies, energy mobility or housing or infrastructure needs. In that particular context, we need to use social innovation along with technological innovation.

(Refer Slide Time: 53:19)



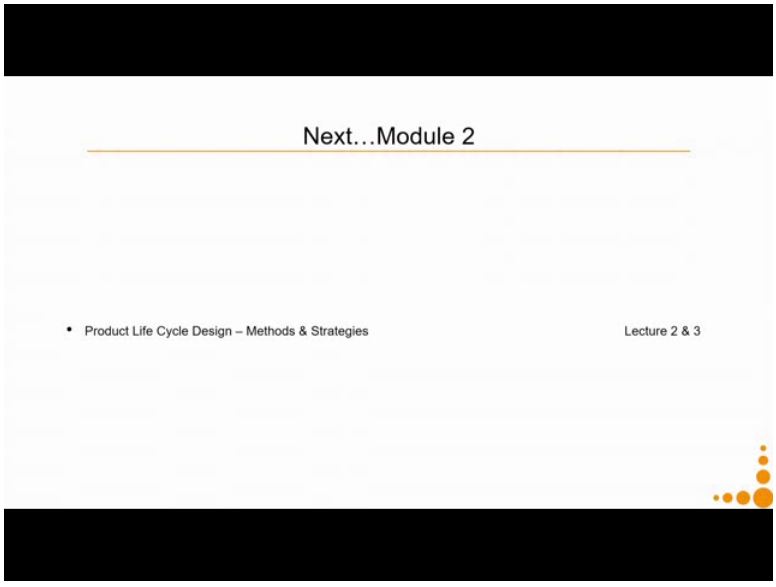
So, our framework helps us to visualize linkages overlaps and complementaries and we can see how we can take aspects from each of these levels and come up to the most optimal solution possible.

(Refer Slide Time: 53:34)



So, our reading material is the same for this lecture as well if you have not read it already.

(Refer Slide Time: 53:40)



In the next 2 lectures of this week, we will start with module 2 which will deal with product life cycle design methods and strategies. Basically this is how we by using this method, we do eco design the approach 2 of product innovation level. Why do we learn about this process this is although, it has its own limitations that it only talks about the production side, it does nothing about the consumption side, but this is a very - very important body of knowledge because it is the only body of knowledge which helps you to quantify the energy the ways the emissions the amount of natural resources that we are

using for making a product. As a result of which I can compare two products, as a result of which I can compare 2 processes.

So, only when we know about this product life cycle design methods and strategies when we develop design and develop solutions at level 2, 3 or 4, we will be able to check what degree of sustainability could be bringing in the through our design intervention.

Thank you; see you in the next lecture.