System Design for Sustainability
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Week – 10
Lecture - 1
Sustainable Product-Service System Design Applied to Distributed Economy

Hello everyone. So, from this module onwards we will be discussing about either sustainability tools and matrices from other domains or from the domain of product and service design itself, but different kind of approaches. So, let us start about something that we will call as distributed economy. So, sustainable product service system design applied to distributed economy.

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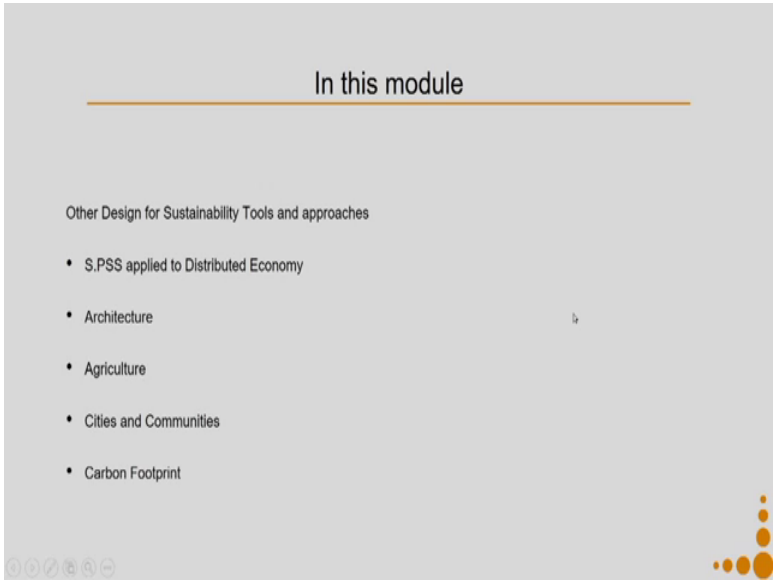

So, in this module we will be discussing other design for sustainability tools and approaches. First will be SPSS applied to distributed economy, then we will have two architecture, then agriculture for cities and communities and then finally, about carbon footprint.

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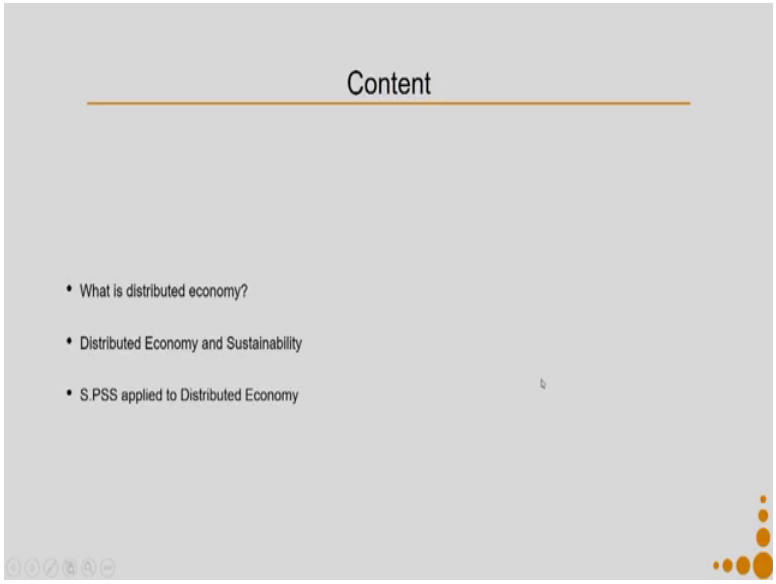

So, in today's lecture we will first try to understand what is distributed economy then, understand the relation between distributed economy and how can it bring sustainability. Then we will see how SPSS can be applied to distributed economy.

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So, in distributed economy, it is regarded as a promising model of locally based sustainability. So, what it says is selective share of production distributed to regions where activities are organized in the form of small scale flexible units that are synergistically connected with each other.

So if you see in this particular definition, there are couple of key concepts. First is it is a share of production distribution. So, that is why I am calling it as a distributed economy, where the production activities are distributed, it is distributed in various regions. The distribution happens in a manner that production is small scale and it happens from flexible units. And all these units are connected to each other synergistically connected with each other.

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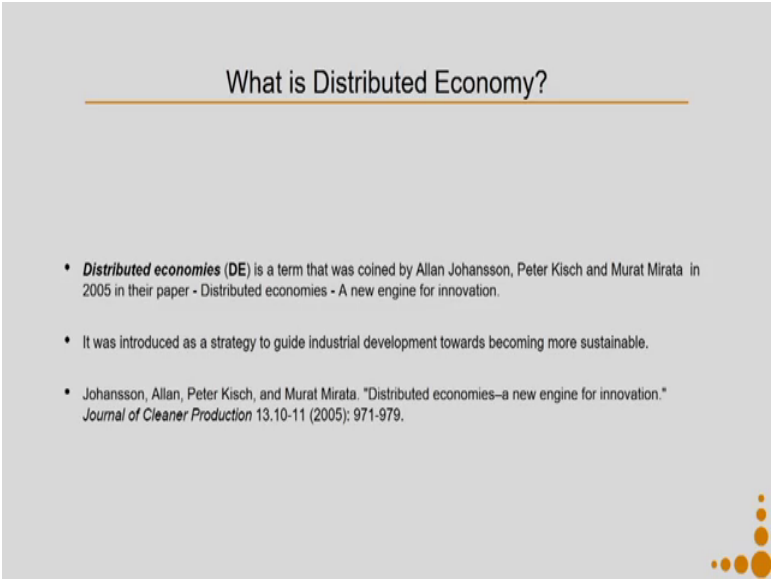

So, this particular definition of distributed economy and the concept of distributed economy was coined by 3 researchers in 2005 through their paper called Distributed economies - A new engine for innovation.

It was introduced as a strategy to guide a industrial development towards becoming more sustainable. If you are interested to know more about it, you can go through this to this paper distributed economies a new engine for innovation.

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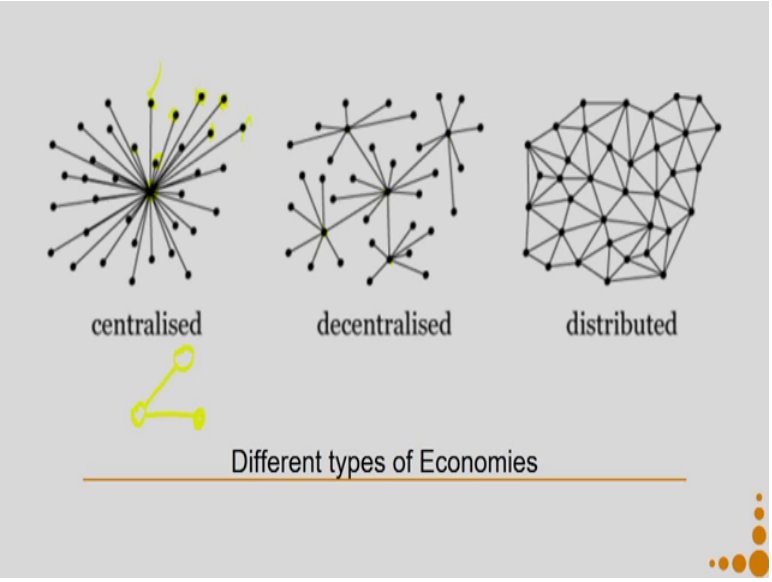

So, now let us try to understand the difference between different types of economies. There are three types of economies, the first one is called as centralized economy. What it means is, I will have a central hub and there will be others. So, these nodes that you can see at the corner these can be some of my producers of components.

So see for example, there is a car manufacturer. So, the car manufacturing happens in a centralized manner. The car manufacture will be at the centre, will be doing all the assembly and manufacturing processes. They will have many suppliers. So, these are all these different suppliers over here who supply different components. For the same components say for example, for the front glass for that to one component this car manufacture can have multiple supplier as well.

So in the centralized economy, the main company who is located at the hub is the largest company. They also have the largest amount of monopoly in terms of economic monopoly, they have more powerful than its nodes. It is possible that at in a centralized economy I have one big player and one of its supplier is also a big player. But in the chain, most of the other suppliers will be smaller players.

So next comes decentralized economies. So, in case of decentralized economies, you can see there are many different centers. So, there are many different centers, say for example; a car manufacturing company. If it has its factories in a different locations, it that does not make it a decentralized activity, because it is still the same manufacturer

they can have their factory located in many different locations. But what this implies that, certain production processes are happening in different locations. Say for example, the Amul model which we had discussed in our earlier lectures.

The production of milk happens in a decentralized manner. So, every house hold owns some number of cows or buffaloes and so the production happens at the house hold level. Everybody brings their milk towards to local collection centers and from the local collection center it goes for further processing to a more centralized location.

Since the producers in this particular context are distributed are spread over a large area, there is no fixed one place where this production happens. Hence we call this as a centralized model. Then comes a distributed model, in case of a distributed model you have very small units, so that in decentralized model also say in the decentralized model also each of these can be small.

But in the context of distributed these each of these entities the nodes over here, they are very much much smaller and the nodes are connected to each other not necessarily each and every nodes does the same functions. Say for example, one particular node might be manufacturing something, another node might be responsible for knowledge production, another node responsible for transportation. But all the nodes are connected to each other and they have almost equal power. So let us see some examples to make these whole things more clear.

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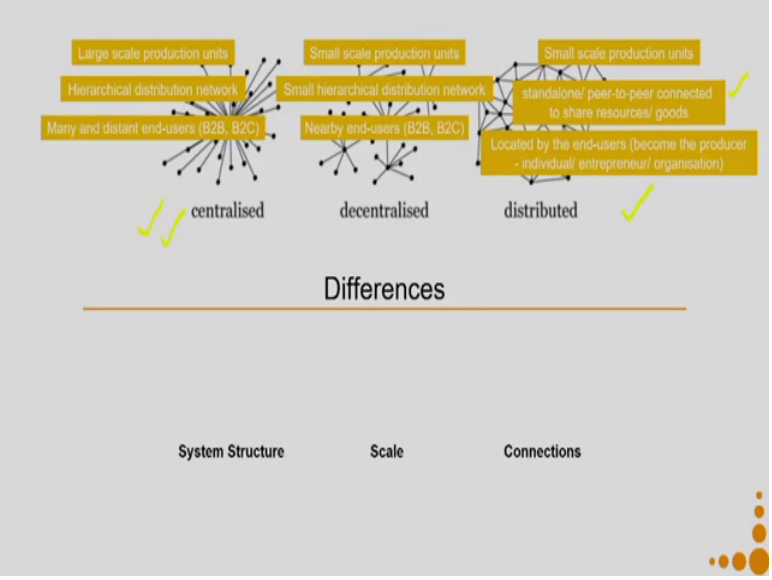

So, the major difference between all these things comes in the system structure in its scale and the connections. So, in case of centralized, you have large scale production units, you have a hierarchical distribution network. So, there is somebody who is at a higher level and then there are others who are at lower level.

Distribution happens from level 1 to level 2 to level 3, so there is a hierarchical distributed network. There are many and distance end users. So, say for example, this car manufacturer of us might be located in one part of the country and through this hierarchical distributed network of distributing cars all over the country and may be also globally they are distributing their vehicles.

So they do have many end users and the end users are very distant. These end users can be business to business users or business to consumer users. Say for example, if the manufacture is a manufacture of trucks, then most likely they will have business to business customers. In case of cars, those cars can be also used by say, a person who wants to start a car renting service, so then that case it becomes a business to business customer. In case it is sold to an individual costumer, who will use it for his or her own requirements and that of immediate family members then it is a b to c customer.

In case of decentralized, you have a small scale production units again, which I call them as small scale because they are smaller scale than that of centralized units. They have a distribution network, but the hierarchy is small because, the nature that you see in this particular diagram. Their end users are also located little bit more nearby than in the case of the centralized economy.

In case of distributed network you have again small scale production units, you can have stand alone peer to peer connected to share resources or goods. So, these distributed say for example, if I install a solar power station in my house then, I am doing energy production in my house. So, I am doing energy production in case, my energy was produced by a thermal power plant or by a hydro electric power plant; I am in the first category, I am using power generalized generated by a centralized system. So, the power generation is happening in a centralized location in particular area and is supplied to my house.

In case I use a solar panel at located in my house and I generate my own electricity and I use that electricity I am going to the distributed model. Why in this case I am generating

energy in a distributed manner. So, say for example, I own a solar panel in my house, my neighbor owns one in their house and in my neighborhood say, there are 100 houses and every house owns one solar panel to generate their electricity.

But we are not connected to each other so, in case when my when I am not using that electricity which is being generated by my solar panel it gets stored. So, that is the context when everybody is doing distributed energy generation and we are in a standalone mode, we are not connected to each other. But this system could have worked more efficiently, if we were all connected to each other. So, my surplus energy production could be used by someone else, again certain agreed upon payment modalities of course.

So as a result of they sharing, more efficient usage of the system is possible. In that case what I call my system as peer to peer connected system. So, we in this neighborhood of 100 houses we are doing distributed energy and we are also connected to each other, so we are doing a peer to peer sharing model. Now say I do not cannot relay completely on solar power because, I think in my location or under the given load conditions that I requires solar energy will not be enough. So, I can also be at the same time connected to the centralized grid system. So, that is another context of distributer. The third one is they are located, so the major criteria of distributedness is determined because, they are located by the end users.

So the end user becomes the producer, now they can be individual entrepreneurs or organizations. So, say for example, if a company decide that, we will run on solar power and they install solar power at their own location. So, that can be also called as a distributed energy generation happening. Now you have to be careful that, even in a distributed economy certain activities can happen in a centralized or decentralized manner. Perfect distribution is earlier theoretical concept. So, what we can do is, we can tend more and more towards distributedness. Because, if you see our network structure this shows that almost all the nodes are have equal amount of power, the everybody in this network is connected to everyone else.

And say for example, a snap happens in this particular link, the whole economy we will still survive because a new only that link broke down, every other link has still survived.

But in actual context this perfect distributedness is not possible, what we can do is we can tend towards being more and more distributed.

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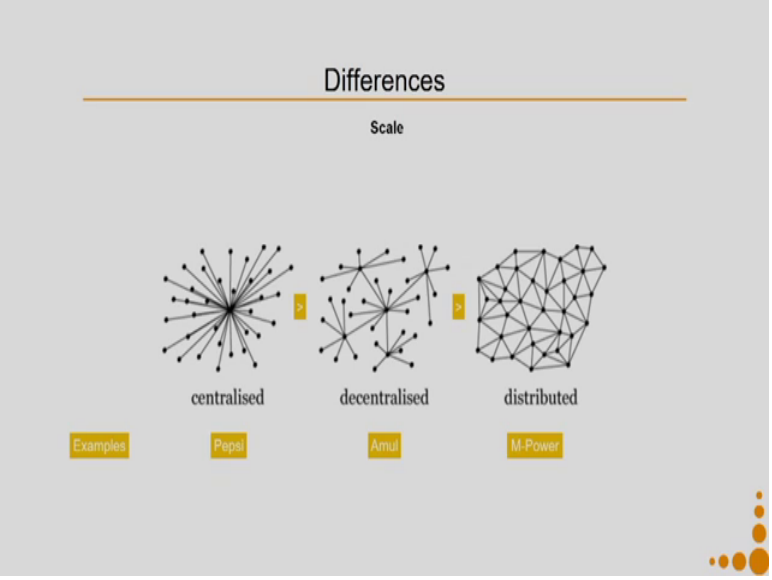

So, if I try to compare scale wise, centralized the scale of centralized operations is very much bigger than that of decentralized than that of distributed. So, say for example, the operations of Pepsi can be called as centralized. So, they have a centralized company, they might have their factories located in many different locations, but they are all own by the same group. So, it is a centralized manufacturing and they have hierarchical distribution network to distribute their products. They also have many suppliers who supply different items, which are required to do the production of the a drink as it is.

Amul can be understood as an example of decentralized, so in this case what is happening in a decentralized manner. Production of milk is happening in a decentralized manner. The company ownership is decentralized. So, there is it is all the farmers, who produce the milk they are part of the cooperative which is and the corporative is called as Amul. But their processing of milk and say production of value added products like butter and cheese and so on they again happen in a centralized factory.

So, not necessarily in a decentralized system everything happens in a decentralized manner. Certain activities can still happen in a centralized manner or in a distributed manner. Similarly even in a centralized organization there might be some places where you can identify a degree of decentralization or distributedness.

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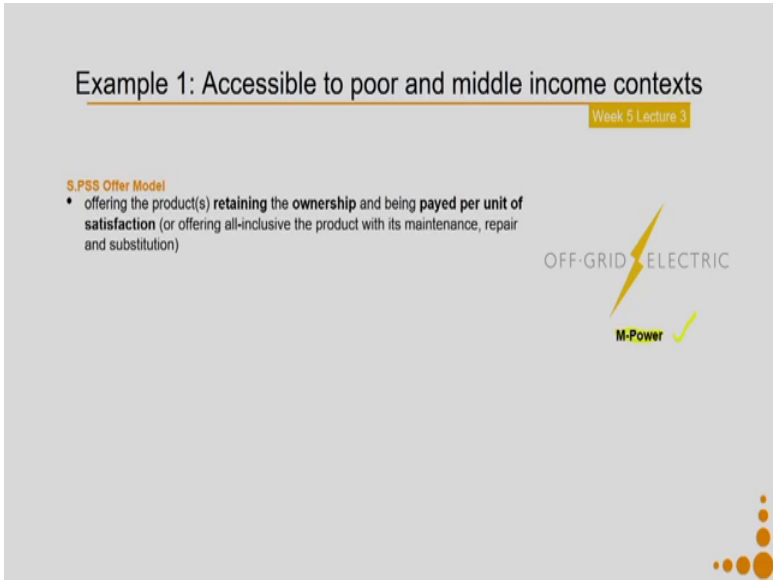

If we remember we saw an example of solar power generating service from Tanzania which was called as m power. So, what was there so, if you want to recall about that particular case study you can go to week 5 lecture 3, there we have discussed about this particular companies offering

So the SPSS offer model that they have is offering the pro so they would offer the solar panel along with two bulbs, all the fixtures and a mobile charging unit. So, all of these is the ownership of all these products is with the main company, which is of grid and their service is called as m power. So, the ownership lies with the company itself. They come and install the whole unit in particular consumers household. So, what I am doing over here is every household generates their own energy. So, I have energy generation electricity generation happening in a distributed manner.

The payment happens by the mobile app and the payment is on the basis of how much power you consume. The company m power is responsible for maintenance of the solar panel, the bulb, the fixtures and the mobile charging unit. So, that is was an example of distributed economy. What is distributed over here, in this particular case may be manufacturing of that solar unit is not happening in a distributed manner; the solar panels, the light fixtures, the bulbs, the mobile charger they are most likely manufactured in a centralized system. But energy generation over here is happening in a distributed manner.

At this moment most of them are stand alone distributed because, two houses or two units are not connected to each other, they are stand alone. So, anybody who is interested they have their unit and they generate their own power, they not connected to the with the neighbor.

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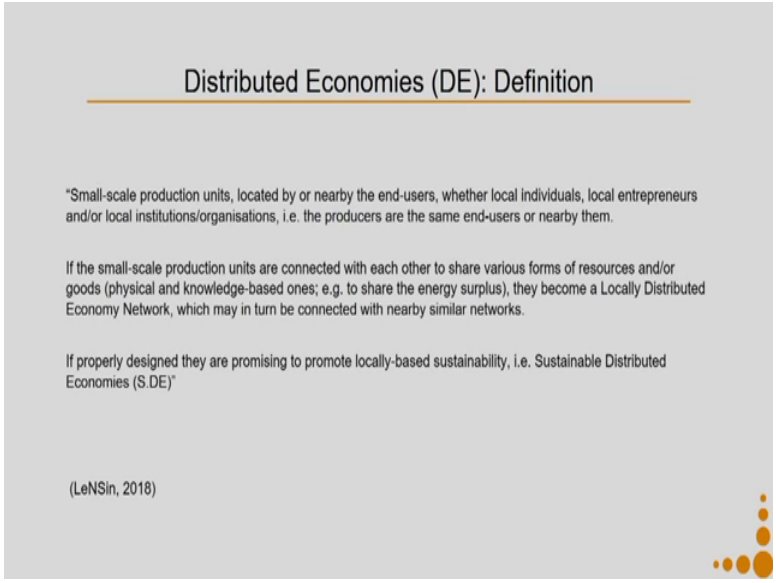

So, this distributed economy and how can we design for distributed economy, how we can bring in sustainability and our initialize I told you that, we are trying to look on sustainable product service system design applied to DE that is the hypothesis that is from the group Lensin in 2018.

So when I introduced this particular group to you of which we are also part so, it is a learning an education network in sustainability. It is a group of currently there are more than 150 universities from across the globe part of this particular initiative. So, this is a developing area and we are trying to develop case studies theoretical theories and how to design and also trying to develop pedagogy material.

So, according to this particular group, the definition of distributed economy is small scale production units located by or near by the end users, whether a local individuals, local entrepreneurs and or local institutions or organizations that is the producers are the same end users or nearby them. So, in the major concern of distributed economy is either the producer is the consumer or the consumer is located very near to the producer and these producers are all small scale production units.

So, if the small scale production units are connected with each other to share various forms of resources and our goods. These can be physical or knowledge based goods like for example, energy surplus in the context of our solar panel. They become a locally distributed economy network, which may in turn be connected with similar with nearby similar networks.

If properly designed they are promising to promote locally based sustainability, that is sustainable distributed economies. So, why can they bring in sustainability, we will discuss little bit more later like, how distributed economy has huge potential for sustainability. But before going into those slides, let us have a cursory discussion on that So, distributed economy here you could see that I am trying to rather than having centralized manufacturing, my production units have distributed over a large region.

A centralized unit because of its centralized strong hub is very strong. So, they have much greater economy monopoly, they have much greater chances of in a power concentration. Where as in this case when these are all small units and connected to each other there is lack of controlling power, all of them are equally powerful. So, brings in better development, each and every chance is that each and every individual can do more progress, more development is high. And if the system is designed appropriately one can also have environmental benefits

So socio ethical benefit is ensured because of the fact that, power distribution manufacturing capability distribution is happening in a better manner and if designed properly, we can also bring in environmental sustainability. Another important thing in a sense centralized economy if, I have to travel a long distance to reach my product from the hub to the final consumer, a lot of energy a lot of pollution is caused due to the transportation service. But in case of distributedness, since the producer and the consumer is either the same or the consumer is located very near the producer; as a result there is huge savings in terms energy required for transportation and in terms of pollution caused during transportation.

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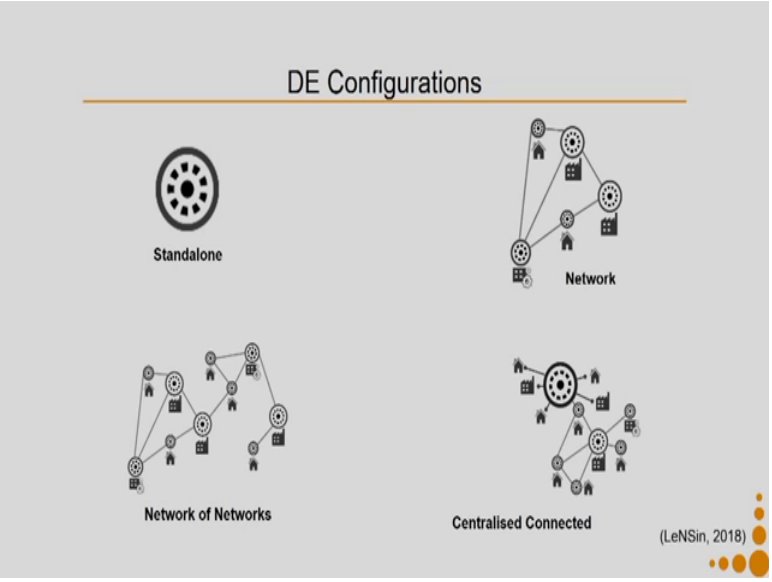

So, now let us look at different configurations of distributed economy. So, there can be 4 different configurations; configuration one is stand alone, I can have network, I can have networks of network and I can have centralized connected distributed economy. Let us see what each of these mean.

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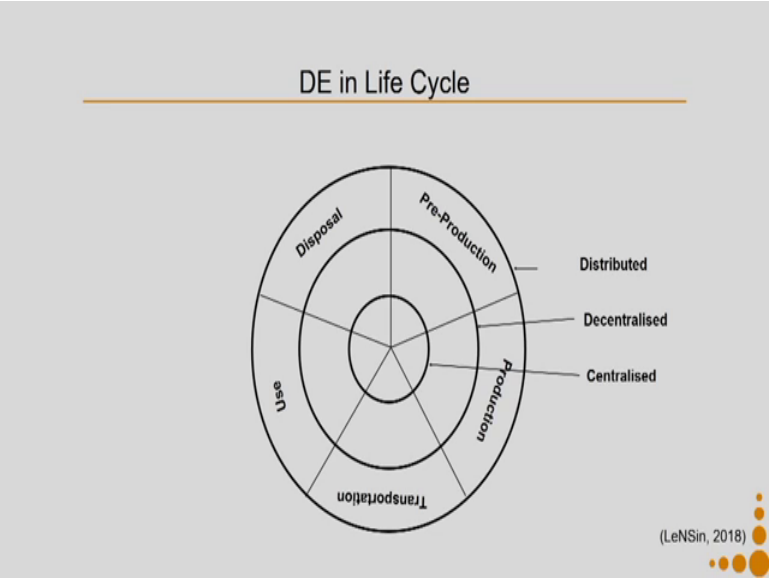

Before getting into what these each of these means, what we also understand what is DE in life cycle. And then we will see what each of these configurations have differences in the level of life cycle.

So when I am talking about DE in distributed economy in life cycle; so life cycle of a product is product of service is preproduction, production, transportation, use and then finally, disposer. So, now, see in this particular chat my outer circle represents distributed economy, my middle circle is for decentralized economy and my smaller circle central circle is the centralized economy. So, now, let us try to understand each of those configurations in the light of this particular life cycle.

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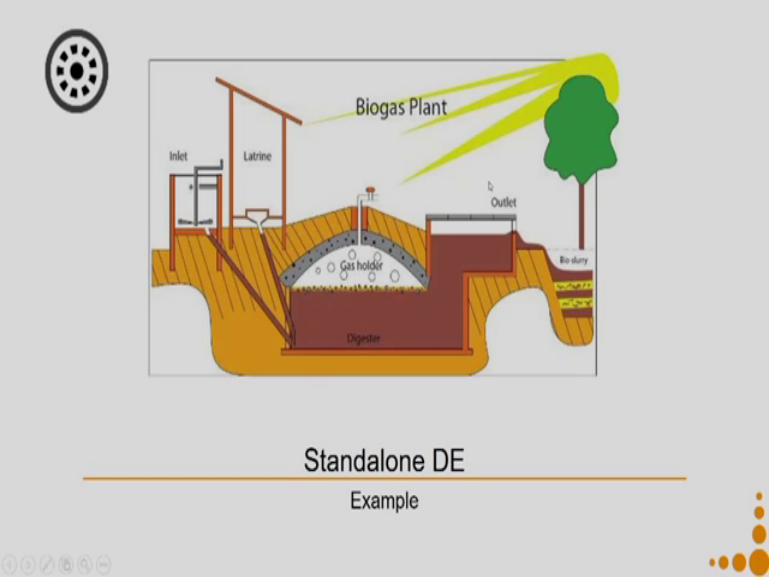

So, my example over here is the biogas plant. So, this particular bio gas plant is connected to the toilet in a house. So, you can see the toilet unit and it is connected to the digester, when the biogas is formulated it is connected to the house. So, what I am doing over here is, this biogas can be used for running or cooking stuff and cooking foods. So, it can become a substitute for LPG or a substitute for burning biomass based fuel, which is the normal occurrence in many parts of the country.

So, now, in case I have this kind of a unit at home because, my production is happening at my own home, so my raw material production for fueling this biogas plant it is happening at a individual house level. When the biogas is produced, the biogas is consumed at the individual house hold level.

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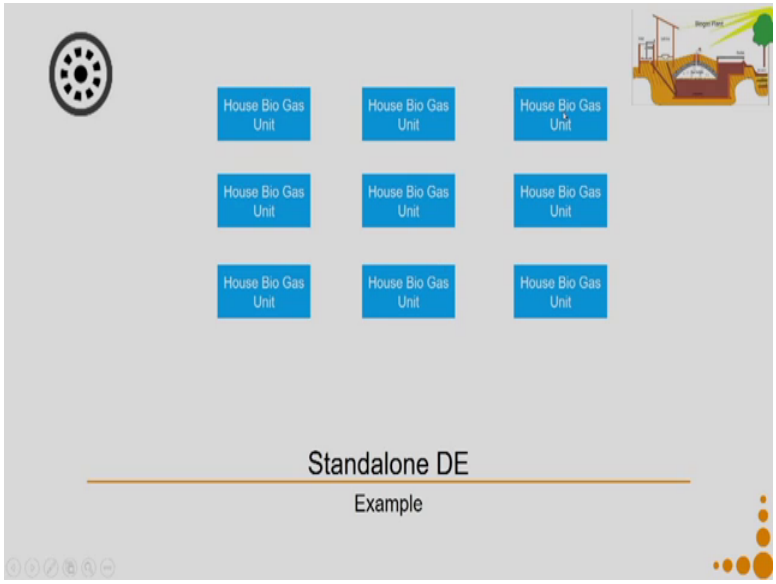

So, my so this is and I am not connected to my neighbor. I have this unit at home and I am doing this production of fuel, which can be used for cooking.

So, my house 1 has a biogas unit, house 2 has a biogas unit, so in my neighborhood this is the structure there are all this different houses with biogas units, but they are not connected to each other. So, this whole system is called as a is stand alone distributed economy. While because they are all stand alone units, they are doing production of their gaseous fuel at their own houses, so distributed economy, but they are not connected so stand alone.

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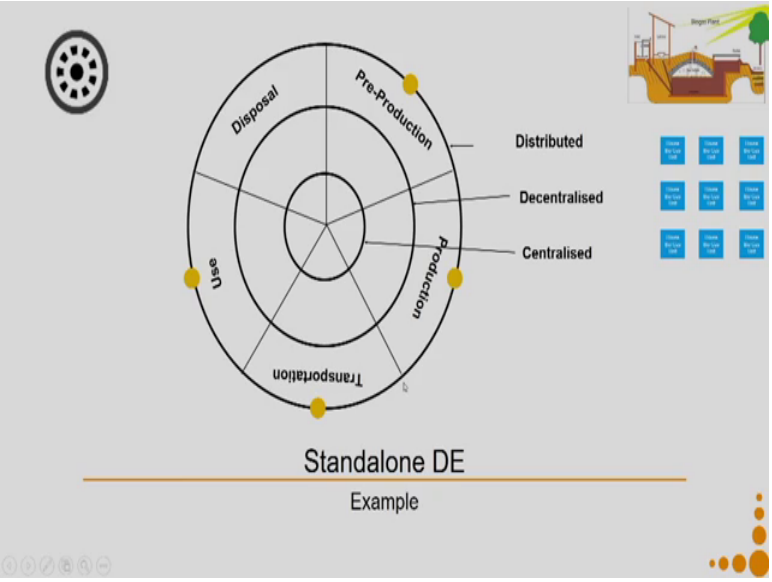

So, in this particular context, if I try to put it into the life cycle model preproduction so, preproduction in terms say I want to construct that particular bio gas unit. Again the biogas unit is being constructed individually by each house, either they might them self construct the house with labor from their own family or they might getting certain other laborers from the labor open labor market and get it installed in the location.

Then also the raw material required for the running of the biogas plant is that raw material production also happens at that persons own house hold. So, I can see the all the preproduction activities are happening in a distributed manner. Biogas production it is also happening in a distributed manner because it is happening in individual houses. Transportation because, it is from your biogas unit up to your own kitchen or from your toilet to the a biogas the raw materials, so there is no centralized transportation either it is a again a distributed transportation.

Use is also distributed and disposal, when the slurry the slurry needs to be disposed of the slurry can be appropriately treated and then it can be used as the manure. Now this manure can be either used by the family itself in their own garden or in their own farms or they can be sold by that. So, the disposal is also happening in a distributed manner.

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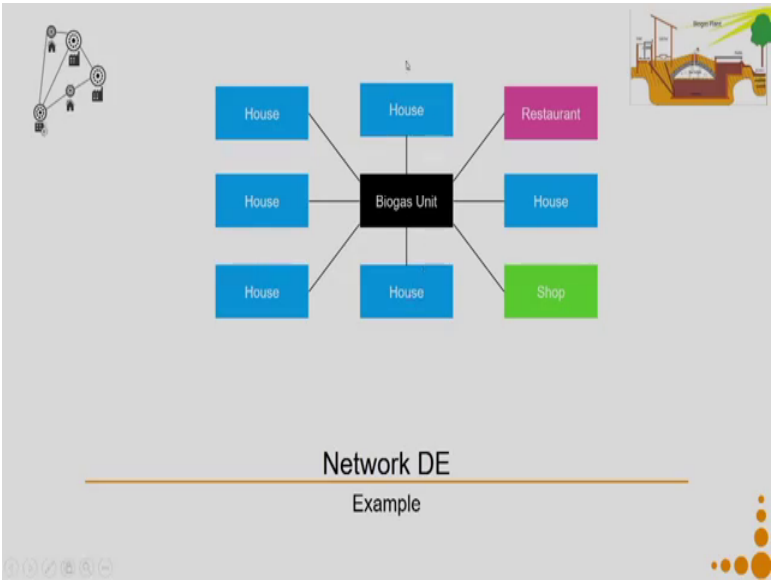

Now let us see an example of a network deal. So, this same biogas plant, say my all my houses have the biogas. So, there is one big biogas units, so you can see the biogas unit is located somewhere over here. So, now, the biogas unit is not located in every household.

When you want to build a biogas unit in every house hold, optimizing the usage is a big problem because, you have to generate enough amount of raw material to run the biogas plant and each house owning one biogas we are consuming, so much of material for construction of that biogas. Excessive biogas is produced in a particular house it cannot be used by in their kitchen, so that is a waste.

So rather than having such kind of a standalone distributed economy, the stand alone distributed economy of biogas does have certain environmental benefits, certain socio economy benefits. But see in case I had a central unit with many houses restaurants and shops connected to it.

I can perform very much better on all the 3 parameters of sustainability. So, I this is called as a network DE, I have one big bio gas plant which is shared by couple of houses, so the raw material from all these houses and may be some restaurant and some nearby shops which are also connected to it come into the biogas plant. And then the biogas plants biogas which is produced goes to each and every house hold. In this particular case I will have to install certain metering units which will meter the input verses the

output for a particular house or a restaurant and then an appropriate payment structure has to be designed. Somebody has to take care of managing the biogas unit.

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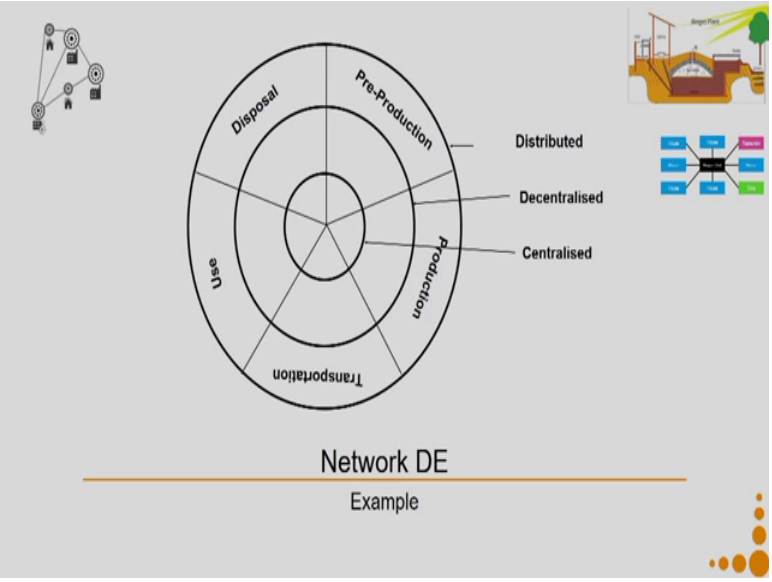

Now, if i put it into the DE life cycle wheel, you can see preproduction is still happening. So, preproduction when I say that the raw material required for running the biogas plant, that preproduction of material is happening, in a distributed manner in each individual house hold shop or restaurant. Now, I can have a situation in which the biogas plant has been built collectively by this entire community. Then the ownership of the unit and the maintenance is also happening in a distributed manner.

In case that is not the context, say there is another third party agency who says that I will install it, I will run it for a certain payment. So, in that case, that particular part is happening in a centralized manner because of the that particular company. Now say production; production right because there is one unit for many households, I can say it is somewhere between so I can say that it is a centralized production system.

But it is not like the other centralized production system say for example, our previous example of a car manufacturer or manufacturers like Pepsi and so on. This centralized still very much more smaller, but because my one unit shared by so many people, so I can still say production is centralized. Because production is centralized, transportation also becomes centralized it, I have to lay down pipeline to transport the material. Usage is again happening in a distributed manner, disposal is again centralized.

Say in case I said that, the biogas plant was not to be owned by a third party, but to be owned by the same community who is producing it, this story would have changed. Then it is then this disposal might also become like everybody's responsibility. Then I can say that in that particular case disposal becomes also distributed.

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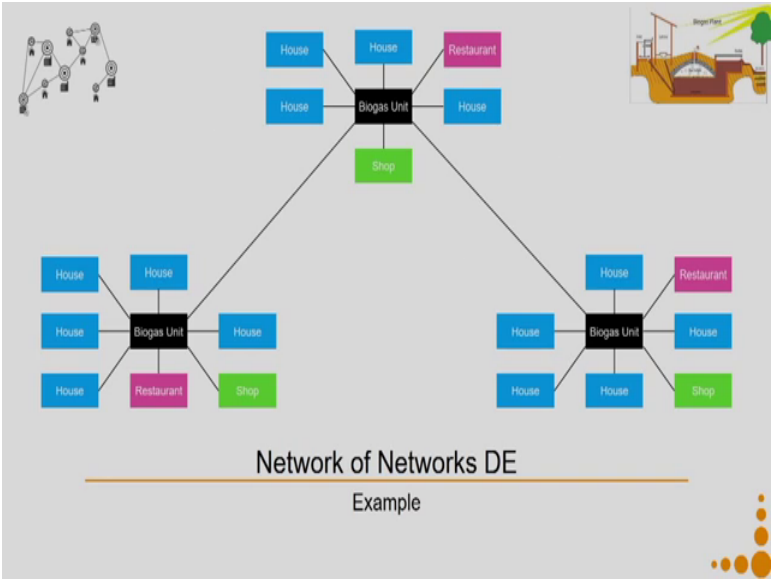

Now, what does a network of networks mean. Say for example, i have a network over here, I have another network, I have another network. And these networks are connected to each other the biogas units are connected. So, what I am not connecting is the line of so that line which is coming from the toilet of a particular house into the biogas unit I am not connecting, I am not sharing that with these biogas plants, but what I am sharing here is excess biogas produced.

So this network is not able to use the excess biogas produced and there is a shortage in this network that excess can go over here. Again you have to have more sophisticated metering and payment systems to run this kind of a network of networks. Obviously, these networks of networks have higher sustainability potential why, because of the whole point that, in case of a shortage over here it can be used over here. In case of one particular house say for example, or say there four houses in this area there is nobody in that house.

So the production also goes down, plus consumption also of course, goes down but, if the production goes down below the consumption levels of what are the other units

required, this unit can satisfied. So, people will have more reliance on the unit they will know that they do not need to have LPG connection at all they can rely on this particular system.

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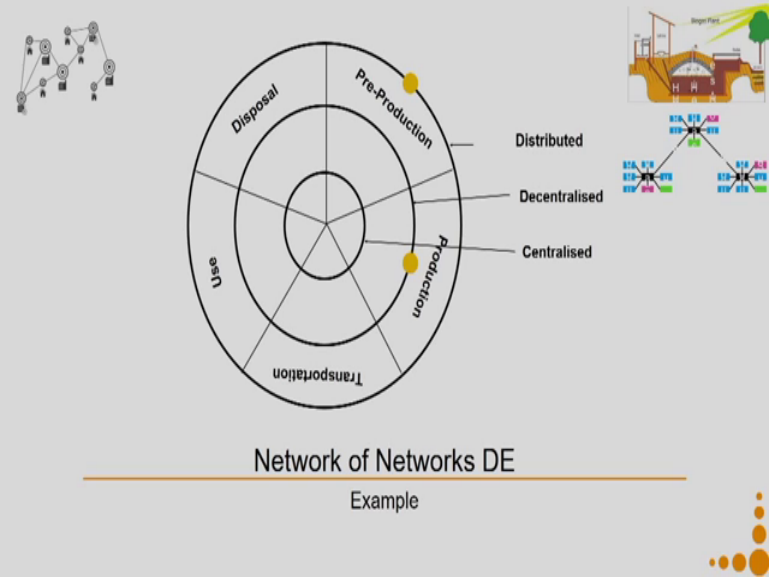

So, if we again look at this particular network of networks DE on the life cycle, so preproduction is again happening in a distributed manner. My production is now decentralized, so I have many different biogas units at which the production is happening. Transportation again become decentralized as a result of it, usage is distributed and disposal also becomes decentralized.

Not necessarily you have to do it in disposal decentralized, you can also think of a way in which you can make disposal distributed or you can make disposal centralized also in this particular context. So, you have to consider what is the situation, what brings an highest level of socio economic and environmental benefit and then take up such a direction.

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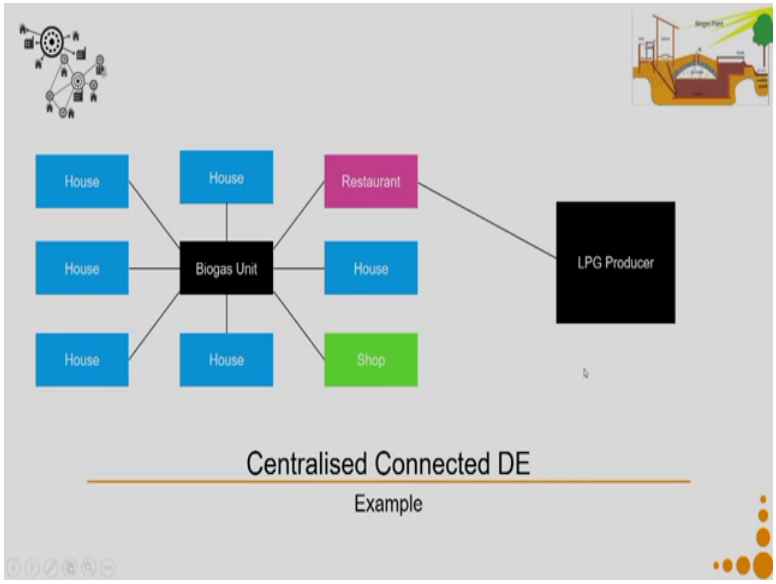

Now, the last configuration is centralized connected DE. So, say for example, in this network of mine, you could see there is one restaurant of course, the production of raw material at a restaurant can be very high as compared to that at house levels, but the consumption of biogas at a restaurant is also very high. Say the restaurant knows that I cannot all my requirements cannot be fulfilled with this biogas unit, only say 50 percent of requirement can be fulfilled.

So, they will also have a connection from an LPG producer So, in this case this is a DE, so it is a distributed economy, it is a network distributed economy, which is connected to the centralized economy because, my LPG production happens in a centralized manner. So, centralized connected DE. Why the (Refer Time: 34:22) restaurant will still want to get connected to the biogas unit because, still 50 percent of its energy requirements are being fulfilled in a more environmental friendly manner. In the more sustainable manner and it is also cheaper, as compared to this centralized function.

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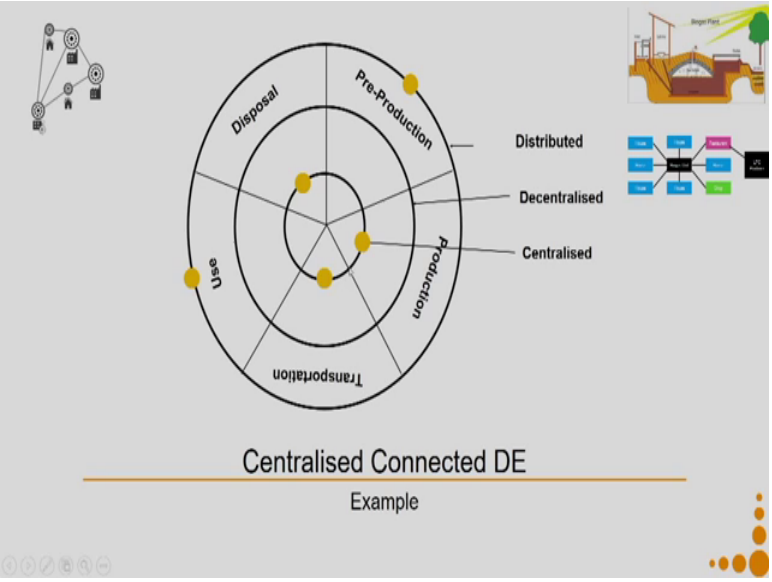

So, in this particular case, again preproduction is happening in a distributed manner. I am picking up here all the context which were from the network diagram, so centralized production, centralized transportation, distributed use and centralized disposal. The only difference over here is coming is, one particular entity or may be more than one entity are connected to the centralized system.

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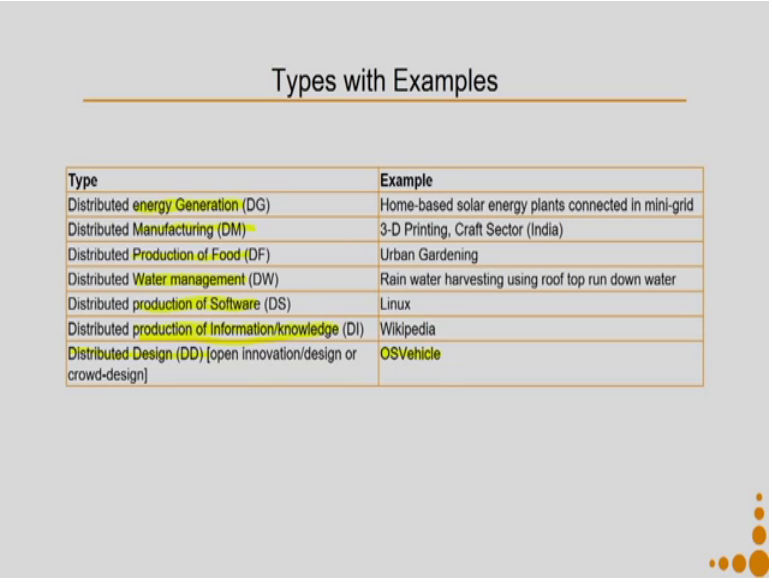

So, you can have different types of distributedness So, you can have distributed energy generations say for example, solar based power generation at homes or it can be also in

companies, you can have distributed manufacturing. Say for example, whenever you do 3D printing that is distributed manufacturing, the craft sector in India works in a distributed manufacturing. So, every craftsman is a manufacturer, they do not belong to one organization under whom they are working as an employee.

Then you can do distributed production of food say for example, in cities if everybody is growing some kind of food in their own home garden, that is an example of distributed production of food. Say for example, distributed water management. So, say if you install a rain water harvesting system in your home, you are doing distributed water management. You can also install sewage water treatment unit in your house and that also become distributed water management.

Distributed production of software, so say for example, Linux is an example of a software which is developed by many individuals. Production distributed production of information or knowledge; say for example, Wikipedia. Anybody and everybody can write a Wikipedia page with fill up with content and give references and that is distributed production of informational knowledge. And the whole platform has become so huge now, that for almost anything and everything that we want to know before strive to find out whether, there is a Wikipedia page for that we can at a very quick glance get and over view of that topic.

Then comes distributed design. So, all sorts of open innovation crowd design they fall under this category. Say for example, you can look up if you do not know what a OSVehicle is you can lookup online. It is a very interesting electric vehicle platform which has been again designed by it is crowd design. So, designed by people anybody and everybody can come and contribute towards the design. So, these are certain examples and typologies. So, in each of these typologies, certain activities can happen in a centralized manner or decentralized manner and there are certain activities which are happening in a distributed manner.

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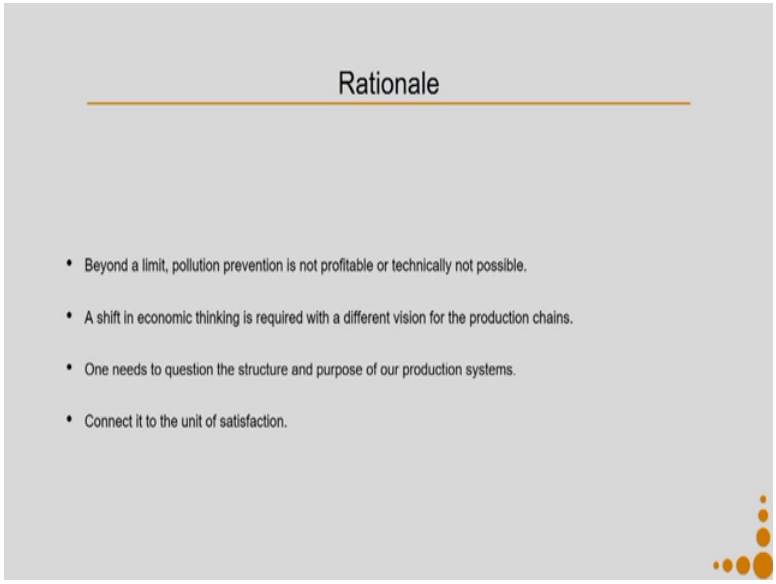

So, the rationale is that beyond a limit pollution prevention is not profitable or technologically possible for a large scale company. So, we need to shift in do a shift in economic thinking to understand how can we reconfigure the production chain. So, not that distributedness is something new, distributedness has always existed. So, if you see distributed water management like having your own rain water harvesting unit or the craft sector, which is existed since so long, where you do distributed manufacturing or if you go to the rural pocket people spin their own thread. Then, they also view their own cloths, so that is also distributed manufacturing. The producer of that cloth is the consumer of that cloth.

So, this distributedness is nothing new what has been become more new with industrial revolution was shifting towards centralized economy. So, that led to many environmental problems economic unsustainability social unsustainability, resulting out of it. So, the need to rethink our production change, why should it be that particular way the centralized with to be profit. Not necessarily all activities not all production activities can be done profitably at a small scale. Say car manufacturing it might not work in a distributed economy model because you need huge setup to manufacture the vehicles.

But many of our production processes can be rethought to see if they can fit in to the distributed economy model. So, one needs to question the structure and purpose of our production system and connected back to the unit of satisfaction.

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So, how distributed economy brings in sustainable development is through regional development. How, so there is reduction in extensive logistic activities like transportation and just because you want to transported over large distances, you have to do very robust packaging. So, it can bring in reduction in transportation and packaging.

Lot of energy can be saved, lot of fuel can be saved, lot of pollution can be prevented. Then customer and production are more connected; as a result better satisfaction is possible. So, if I am myself the producer of what I want to consume, I know what I require better than somebody who might be located 1000's of miles away from me. So, the chances that better satisfaction is possible because customer and production are more connected or are the same person is higher.

If I am more satisfied I might use that product for more longer time. Avoidance of activities like restructuring of manufacturing activities and outsourcing these 2 countries or regions with lower production cost, this can be also avoided. So, say for example, now when if I say that in my country production is becoming very the expensive which is to country x. I am taking away jobs from my country, I am also I am just shifting pollution from happening in location a to location b, but globally we are all connected. So, that particular strategy impoverishes the region were the factory was initially located and it does not bring in any other improvement any improvement in environmental aspects.

Possibility of value creation connected with regions and culture. They when activities use to naturally happen in a most distributed manner, we would always think of a we would always connect a region with all the things that they manufacture. Say for example, Banarasi silk or sweet coming from the Mathura. So, we were always connected a region or a culture with the material that they produce or the services that they produced, which is about socio sustainability culture sustainability. So, that can be brought in through this distributed economy.

Possibility of using renewable energy, local material resources and manpower is also possible because, these are small production units. Renewable energy generated on site can satisfy their requirements. So, rather than huge production units where the renewable energy is generated on site cannot satisfy the requirements. Also we will be able to use more local materials that will boost the local economy, local manpower usage that will again for the boost the socio economy context of the region.

The possibility to empower individuals and community and reduce poverty and inequality is also provided by this opportunity. You have to be very careful distributed economy does not guarantee environmental sustainability, you have to build an environmental sustainability to get that similarly, distributed economy although it has promising socio economic benefits, but you have to build in to it features of sustainability.

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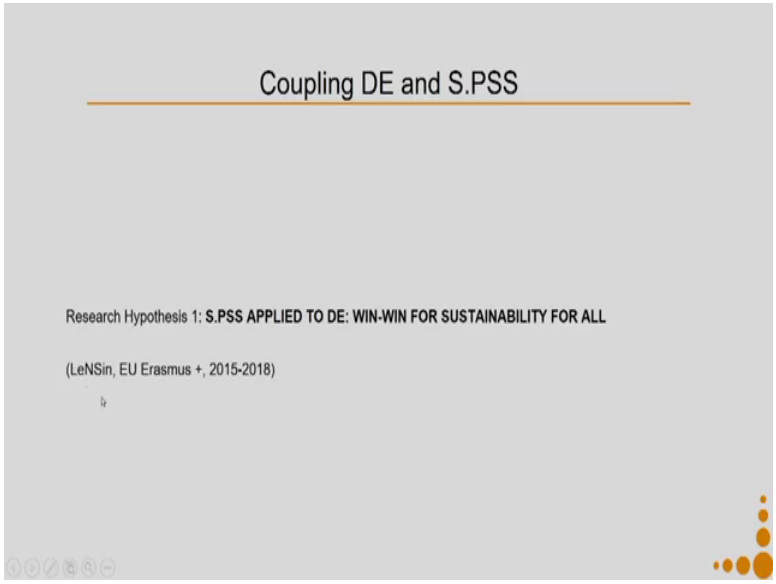

So, the research hypothesis of the lens group is that, if I use sustainable products of a system design, principles and apply it to distributed economy I can get win-win sustainability for all. So, say for example, the example that I spoke to you about empower, the distributed renewable energy related company they are offering an SPSS. So, they take up this concept of distributed energy generation, that is solar power and they are using an SPSS model, so they have married the 2. So, SPSS applied to distributed economy and as a result people who were not connected to the grid in Tanzania of or whom it was too expensive they are getting the benefits of having electricity at home.

So, you are getting clean energy, you are having an socio economic benefits. So, that proves that SPS is applied to DE has the very good win-win possibility for sustainability. So, you can use all the 2 that we discussed for designed for sustainable PSS and try to see can you build it in a distributed economy. Now since you know distributed economy is and that can give result to more sustainable solution. In distributed economy it does not need to be that distributedness has be in each and every activities, certain activity; say production or design or energy generation can happen in a distributed manner.

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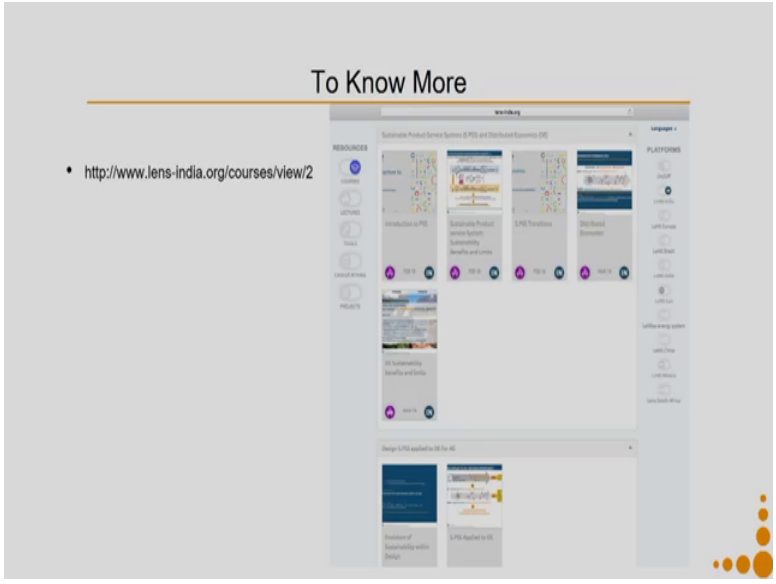

So, we keep on uploading more and more about how to design for distributed economy, case studies, pedagogy material on our lens India platform as well as the lens international platform. So, to know more about this particular area, you can logon to this

particular website. And on this website, so you can see I have clicked on course, so you click on the course icon over here. So, that this is highlighted f not and you scroll down to reach to this subsection which is called sustainable product service system and distributed economy and then the next subsection which is called design SPSS applied to de for all.

So, you can know more about this aspect. On this platform you can also search on distributed economy an you will get to know more about this particular area.

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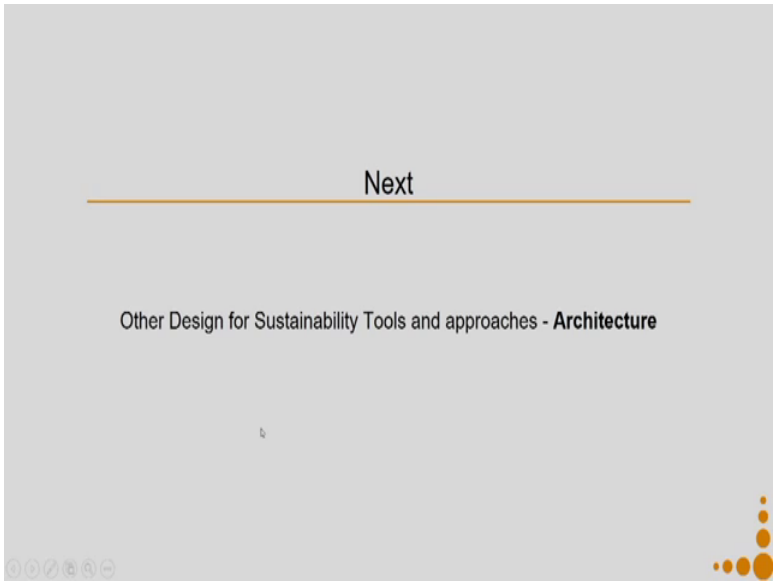

So, in our next lecture we will be discussing about design for sustainability tools and approaches in the domain of architecture. So, architecture is a very very important domain. So, as per report out of the entire global energy 30 to 40 percent of the entire global energy is consumed by buildings. So, you can imagine the impact of buildings on sustainability. Hence, we will discuss about certain tools and approaches towards achieving sustainability in the area of architecture in the next lecture.

Thank you.