United Nations Sustainable Development Goals(UN SDGs)
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Analyzing SDG connections, grouped into People, Ecological, and Spiritual categories
Part 2

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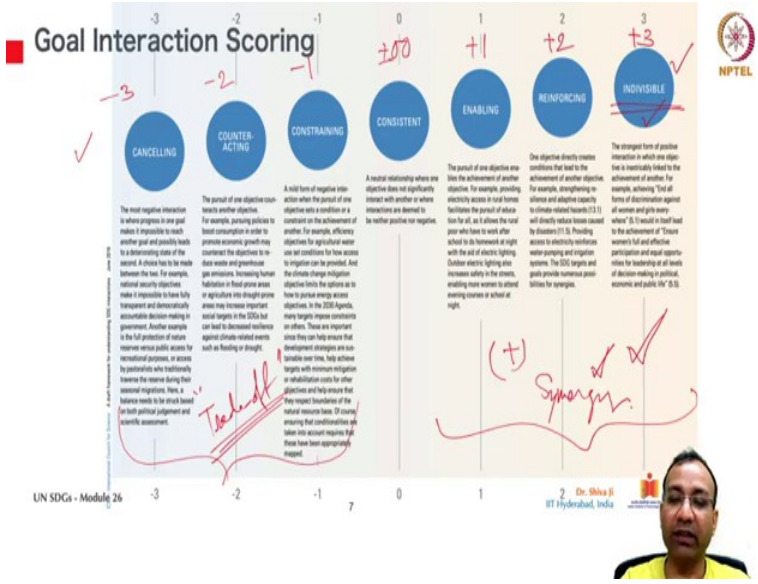

So, why are these interactions even important? In the policy arena most discussions about coherence and interlinkages in the 2030 agenda have focused on the existence of trade-offs and synergies between sectors and the need to map them out and identify ways to alleviate or remove trade-offs and maximize synergies. So, in the coming slides we will see what are these trade-offs and what are these synergies. These are actually 2 major factors in the overall interactions of targets in the whole set of SDGs.

So, somewhere we saw in the previously in this slides how these relationships sometimes they are going in the negative up to minus 3 level, minus 2 level, minus 1 level, plus minus 00 level, plus 1 level, plus 2 level, and plus 3 level. So, these are the 3 different types of interrelationships here it is in the positive side up to the very high degree, here it is negative side is a very low degree and so on.

So, there are seven at the scale of these seven these levels. So, in this ones you can say here things are working out very nice and one initiative is supporting to the another very directly and it is so kind of an intertwined that it is kind of individual, the aims and objectives they are individual and they are working in a total sync. So, these actually ranges we call it things are working in synergy, so things are working as per planned and as intended in the positive direction.

And here it is a kind of negotiation, so that is that trade-off you have to make the examples we saw how for keeping a national reserve but allowing some excess it to that place for tourism or recreational or maybe other research or maybe some sort of activities. So, there is a small negotiation you need to make with the first one, first variable in order to facilitate the second one, so that is trade-off. So, all of those such relations they fall under this trade-off category.

So, these are the 2 major distinctions you will see in these points in the coming slides in these interrelationships. However, this area currently has a weak conceptual and scientific underpinning and no common framework to analyze the nature and strengths of these interactions and the extent to which the constrain or enable policy and action. Indeed there is a need to develop guidance and tools that can help policy makers and investors identify and manage synergies and trade-offs across goals and targets.

Before the stage of policy formulation including the setting of context specific such as national or local targets and indicators research needs to be conducted into the nature and dynamics of the interactions below we introduce a more refined typology of interactions for use in empirical research into SDG interactions. Such research needs to be developed to provide a usable knowledge base for both policy level decision support and the design of implementation strategies.

So, why these 2 things are essential to understand the nature of interactions is because of this you will be in a position to take a practical call what to do in what kind of circumstances and how to go about it. So, you see in in this description it helps you understand this whole

dynamics of targets how it is happening because sometimes these implementations they actually vary from place to place. In one country it may be having some nature of work, in another country there may be that the nature of work the nature of implementation may differ.

So, how this whole dynamics is going to take place that actually we get to know from these synergies and trade-offs and accordingly we actually frame our policies and implementation strategies. So, it is an essential understanding for implementation of SDGs in places. And this is the reason it is essential to understand these interactions.

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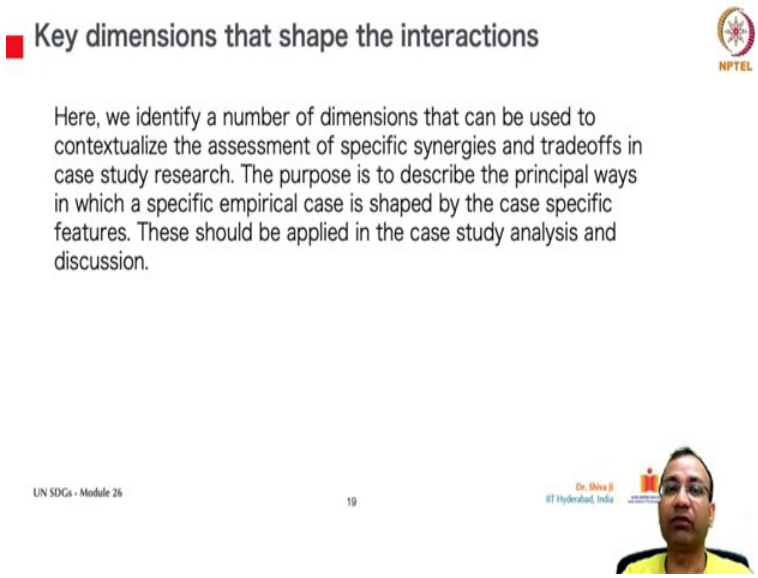

So, now we will see some key dimensions that shape the interactions. Here we identify a number of dimensions that can be used to contextualize the assessment of specific synergies and trade-offs in case study research. The purpose is to describe the principal ways in which a specific empirical case is shaped by the case specific features, these should be applied in the case study analysis and discussions.

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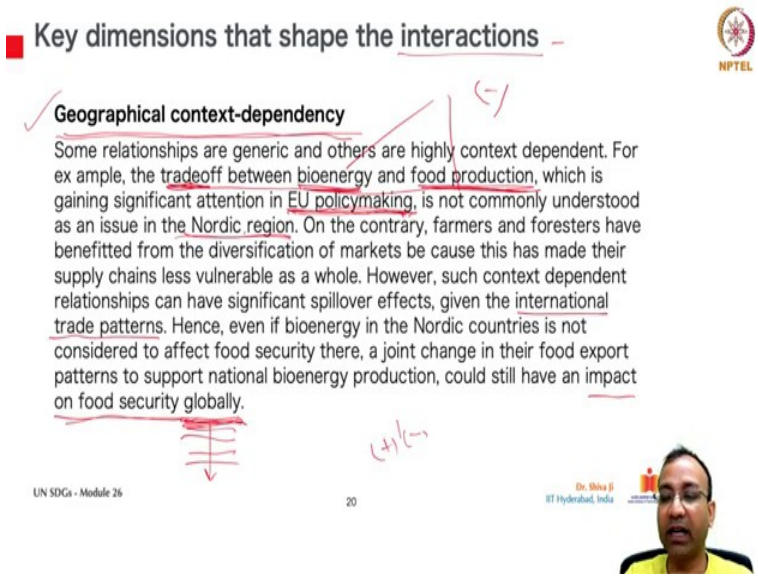

So, in this one the first we see about geographical context dependency. Some relationships are generic and others are highly context dependent. For example, the trade-off between bioenergy and food production which is gaining significant attention in EU policy making is not commonly understood as an issue in the Nordic region. On the contrary farmers and foresters have benefited from the diversification of markets because this has made their supply chains less vulnerable as a whole.

However, such context-dependent relationships can have significant spillover effects given the international trade patterns. Hence, even if bioenergy in the Nordic countries is not considered to affect food security there, a joint change in their food export patterns to support national bioenergy production could still have an impact on food security globally. So, if you see this example is taken from this place EU policy making, a trade-off happening between bioenergy and food production.

So, that means there is some form of negative interrelationship between these 2 and on the contra but it is commonly not understood to has an issue in the Nordic region. So, interestingly if you see this is not having the similar kind of impact perhaps in the Nordic region and that is why it is not an issue. But it is a kind of a an issue in the EU policy making in the EU and they are talking about it, they are discussing about it, they are working about it.

So, you see how the nature of sum of these interactions may vary from place to place, previously just be saw and this is one example. So however, such context dependent relationships have significant spillover effects giving the international trade patterns. So, this is where internationally it takes a shape and makes, gives you a pattern, what are the places

where synergy is happening, among what sectors, among what SDGs, among what the targets.

And on the same line which are the places where this trade-off pattern is happening among SDGs, among the targets, among goals. Hence even if bioenergy in the Nordic countries is not considered to affect food security there a joint change in their food expert pattern to support national bioenergy production could still have an impact on food security globally. So, still there may be some form of interaction, some form of negative impact that is mentioned over here.

If it goes at global level so for food security, so this is the mention. Even if it is not of that much of extent or it is not a negative side it is not in the trade-off zone but still it can have some impact if we calculate it with the food security at global level. So, this is one actually geographical context based dependency, location based, place based dependency like how the at the same very set of variables can have positive and negative impacts in different places.

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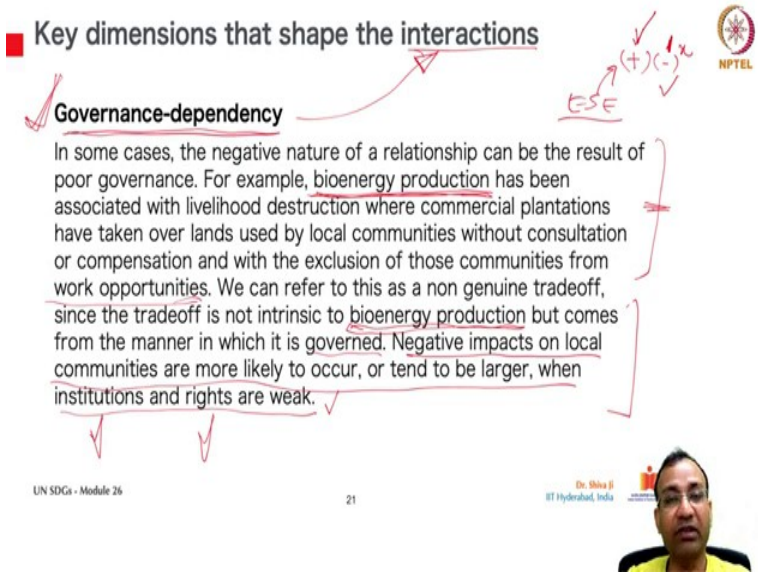

Next we have a governance dependency. In some cases the negative nature of a relationship can be the result of the poor governance. For example, bioenergy production has been associated with livelihood destruction where commercial plantations have taken over lands used by local communities without consultation or compensation and with the exclusion of those communities from the work opportunities.

So, you can see in some places units for bioenergy production they have taken away the lands, of course for any such initiative you need a land as a very first a resource. So, but in

the ESE aspects we have seen for any such initiative what are the consideration for social sustainability, how the people who are, who have been living there at that place from before the initiation of that project how are they going to get affected.

And what are the positive and negative impacts they are going to experience and how this negative impacts can be compensated by more and more positive kind of initiatives and things. So, the mention here given is these people they were not even compensated properly and they were not even given work opportunities in those units. So, bringing huge pile of negative impact on them so of course it is a kind of issue of a governance, why there is no policy to safeguard the interest of those people and the local people. So, this is the government, governance related dependency.

We can refer to this as a non-genuine trade-off since the trade-off is not intrinsic to bioenergy production but comes from the manner in which it is governed. So, if you see bioenergy production in itself is not going to have an impact of a negative nature on the society but how it is being managed, how it is being organized over there that process actually is having some issues, some flaws which needs to be kind of address. So, definitely it is a process based, is a governance based issue which definitely can be solved by proper action points.

Negative impacts on local communities are more likely to occur are tend to be larger when institutions and rights are weak. So, very essential, very interesting and point over here for everyone for the whole society at large for proper safe guarding of your rights, proper safeguarding of your own interests for that you need proper institutions, rules, regulations, policies in place law in order. Maybe constitutionary provisions, regulatory provisions to keep a check in such unusual situations if they might occur sometime in future.

So, beforehand itself the society needs to be kind of prepared to take care of such eventualities. So, governance related dependency which becomes a key shaping agent for interactions, it can go into the plus dimension, it can take you even in the negative dimension. So, one needs to have a proper check of properly those clauses and those frameworks which are people-centric, which are society centric, which are placed centric.

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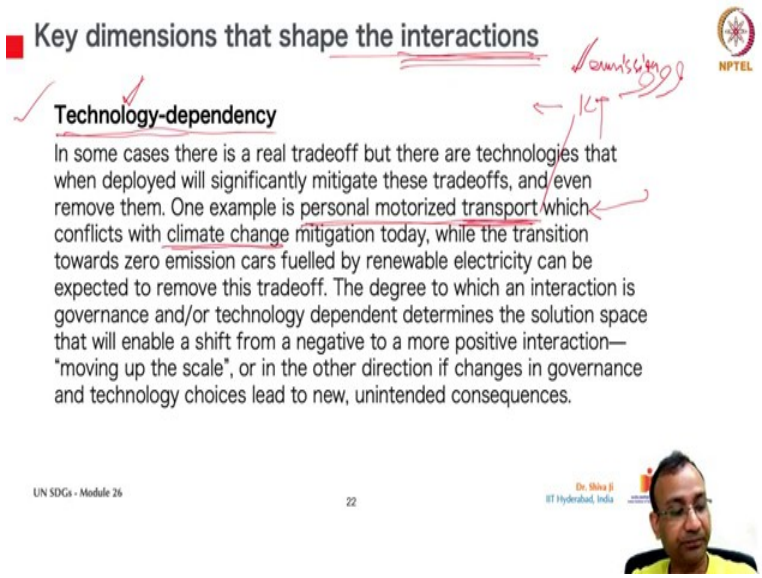

Moving on, now we are at the level of technology dependency. So, let us see how technology plays an important role in shaping those interactions of SDGs and targets and action points. In some cases there is a real trade-off but there are technologies that when deployed will significantly mitigate these trade-offs and even remove them. One example is personal motorized transport which conflicts with climate change mitigation today, while the transition towards zero emission cars fuelled by renewable electricity can be expected to remove this trade-off.

The degree to which an interaction is governance and or technology dependent determines the solution space that will enable a shift from a negative to a more positive interaction moving up the scale or in the other direction if changes in governance and technology choices lead to new unintended consequences. So, very interestingly put up over here if you see personal motorized transport like personal cars and personal 2 wheelers and 4 wheelers or SUVs and stuff definitely they help a lot at personal level at the family level at household level to your facility to your ease of access to the ease of transport.

But it is it is a directive contributor to the climate change phenomena also. So, if we take care of if this vehicle is hydrocarbon based or a conventional fuel based of course ICT vehicles and things. So, of course it is going to give you lot of emission, lot of impact. So, if we deal with the technology and make these vehicles based on clean energy definitely both will be a win-win situation, one can have a personalized motor transport solution as well as will have very little or almost nil an impact on the climate change.

So, it is a technology dependent interaction a key interaction which is going to shape this thing. So, we need improvement, we need investment in technology to improve on these emissions in order to facilitate sum of such concerns which talk about personalized motorized solution transport solutions, it is a very apt example.

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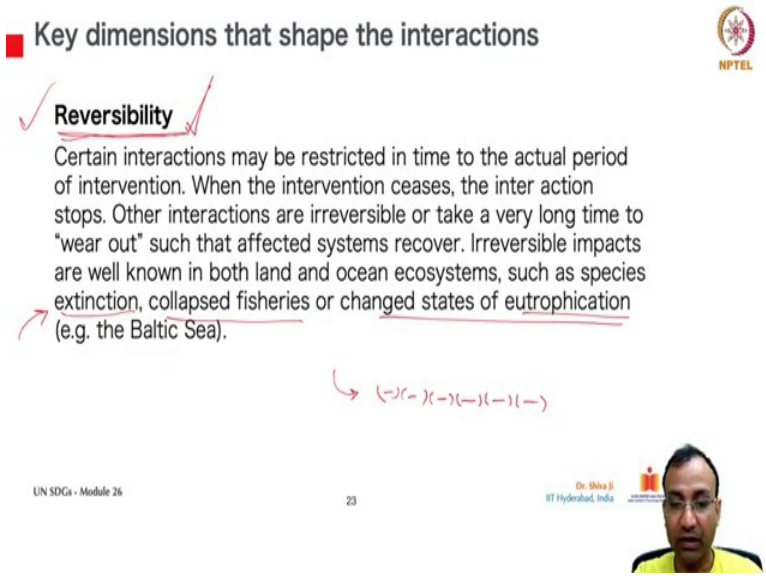

Then we have about reversibility, certain interactions may be restricted in time to the actual period of intervention when the intervention seizes the interaction stops. Other interactions are irreversible or take a very long time to wear out such that affected systems recover. Irreversible impacts are well known in both land and ocean ecosystems such as species extinction, collapsed fisheries or changed states of eutrophication.

So, extinction collapsed fisheries or changed state of eutrophication. So, these processes if you see some of these are natural processes and things if you see the extent of damages and impacts of what humans some of the communities some countries are causing to the ecosystem.

Some of this is reversible because nature has its own recovery powers, recovery strength it can recover if you pollute a water body or maybe a river or a pond or something after a few years, after some time if you allow it to heal if you do not continuously pollute it, it may go back to its natural state in some time maybe subject to no more pollution or maybe few years time.

But if the impact, if the damages are regularly occurring at continuous basis then the effects maybe everlasting and maybe irreversible that you cannot go back from where you have

started. So, and some of those examples are extinctions what if a particular species is lost because of a human intervention it cannot be recovered back, it cannot be retrieved back in its own original form and format, so that will be a permanent loss which cannot be reversed.

So, this is the point we are talking about here about reversibility. So, in some cases it is okay, but in some cases where this reversibility is not possible we must be very very careful, extremely careful to not to cause any more damages or any more harms in those circumstances. So, this is about reversibility.

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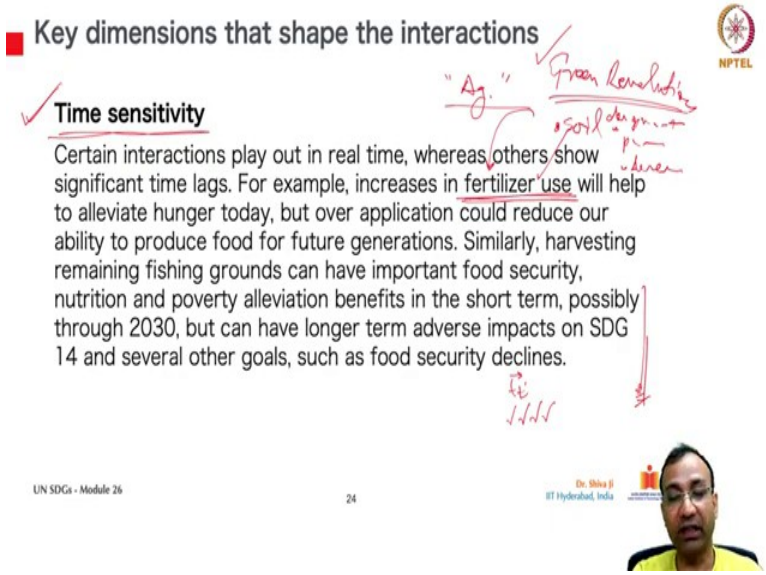

Time sensitivity, so let us see. Certain interactions play out in real time whereas others show significant time lacks. For example, increases in fertilizer use will help to alleviate hunger today but over application could reduce our ability to produce food for future generations, uses of fertilizer.

Similarly, harvesting remaining fishing grounds can have important food security, nutrition and poverty alleviation benefits in the short term possibly through 2030 but can have longer term adverse impacts on SDG14 and several other goals such as food security declines. So, if you see with the time what is important and what is kind of essential for food security, for feeding everyone, every member of the society and what repercussions it may have.

So, one of the best examples from our own country and many other countries is the extensive use of fertilizers and pesticides, insecticides in the agriculture industry. So, agriculture is so dependent on these things particularly fertilizers. So, the Green Revolution we see happened several decades even back in India and at that time India was largely dependent on food

imports and this is the one phenomena which gave strength to India for its own standing on its own and securing its own food reserves and going totally independent from procuring any basic food items from outside.

And it was able to solve this food crisis which was going on at in our country. But there are some repercussions. The extensive use of fertilizer actually led to several situations such as soil degradation and pollution and diseases and many other kind of things which happen to people from those areas respiratory diseases, skin related conditions and in some cases people relate to even carcinogenic phenomenas also from extensive use of fertilizers in agriculture.

So, it is a kind of you see it is a very time sensitive kind of thing what was needed at what point of time at to the most accordingly you take your call. So, if you are is so much into the necessity of food security for example in some countries from third world definitely you may not actually want to focus more on the repercussions of using fertilizer but you want to secure food supplies at the first hand so it is a time sensitive (())(21:55) once that objective is kind of stabilized you can go back and revise or maybe improve on the impacts of fertilizer on the food production processes.

So, it is a time specific kind of thing what was needed at some point of time may not be needed in the same proportion in the same extent maybe at another time. So, implementation details would definitely vary from time to time from T to T dash what are the changes which have occurred accordingly policy and implementation techniques can be revised.

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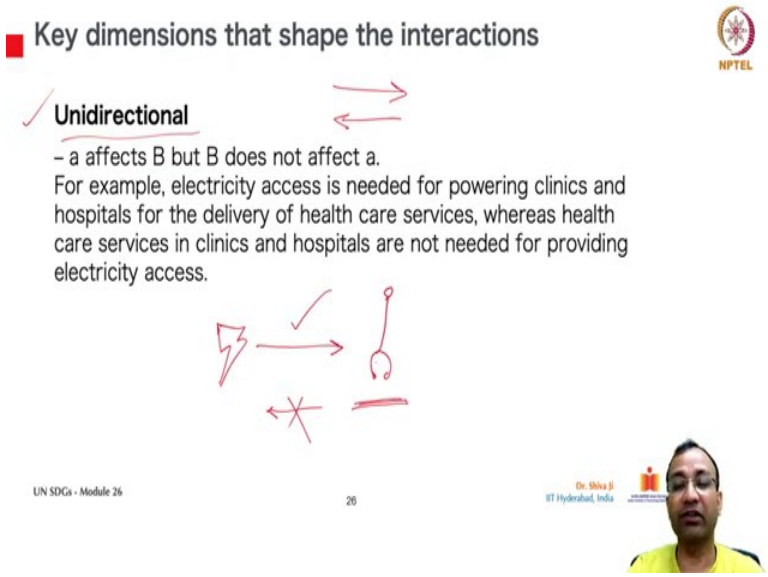

Next we have directionality. The interaction between 2 areas can be unidirectional or bi-directional and symmetrical or asymmetrical. So, we have these 2 variables x and x dash, so this may be unidirectional just one way or maybe this way or maybe bi-directional, both ways, it is impacts.

And it may be symmetrical or it may be asymmetrical also maybe this one is like having some impact of maybe 1 degree and this one maybe having an impact of maybe 2 degrees higher degrees. So, this is also possible that it may be symmetrical kind of a proportion or maybe asymmetrical proportion, maybe one directional on one side maybe left to or to left or maybe bi-directional both sides.

If there is no relation then of course there is no need of this directionality or those or study those 2 variables they will be having some no relation at all but if there is a relation or if there is some kind of impact, some kind of change, some kind of interaction it may happen likewise, so we will see in detail here next. So, about unidirectional, one day either this way or either this way.

a affects B but B does not affect a, so this is also possible, it is just maybe a is affecting B and B does not affect totally a or maybe vice versa B is affecting a and a is not affecting B in any way. So, that is a unidirectional relationship. So, here for example, electricity access is needed for powering clinics and hospitals for the delivery of healthcare services, very essential, whereas healthcare services in clinics and hospitals are not needed for providing electricity access.

So, you see this is just a one way relationship if this is there is proper regular and uninteractive power supply so there will be kind of a very efficient one can say like a supply of health services this is the stethoscope. But for the clinician hospitals and health care services it is not essential they will have some impact on the electricity distribution, so this is, this has this relationship just in one direction, so I hope you understood with this example.

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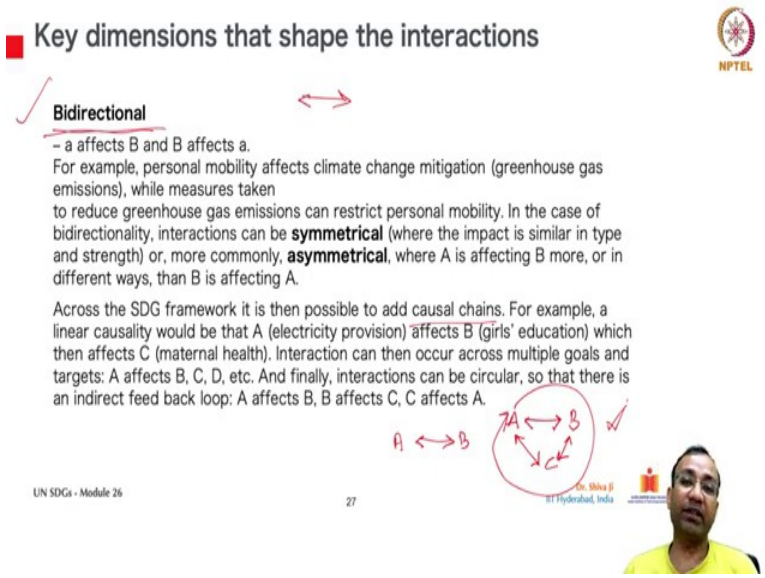

About bi-directional, bi-directional both ways a affects B and B affects a also. For example, personal mobility affects climate change mitigation, greenhouse gas emissions more and more, more personal vehicles more pollution. While measures taken to reduce greenhouse gas emissions can restrict personal mobility. In the case of bi-directionality interactions can be symmetrical where the impact is similar in type and strength or more commonly asymmetrical where A is affecting B more or in different ways then B is get affecting A.

Across the SDG framework it is then possible to add cause chains, causal chains in causal diagrams. For example, a linear causality would be that A electricity provision affects B girls education which then affects C maternal health, interaction can then occur across multiple goals and targets A affects B, C, D, etc etc. And finally interactions can be circular, so that there is an indirect feedback loop A affects B, B affects C and C affects A.

So, if there are only 2 variables the relation is bound to be only cyclic, linear sorry, but if there are more than 2 variables A, B and C, A is affecting B, B is affecting C and in turn it is possible that C may be affecting A, so this forms a loop. So, what goes comes around. So, you can understand this becomes cyclic interaction phenomena over here, it may be unidirectional, it may be bi-directional or it may be in one place it is unidirectional another place it can be bi-directional and so on. So, those variations those permutation combinations are possible but interactions can be symmetrical also for your understanding.

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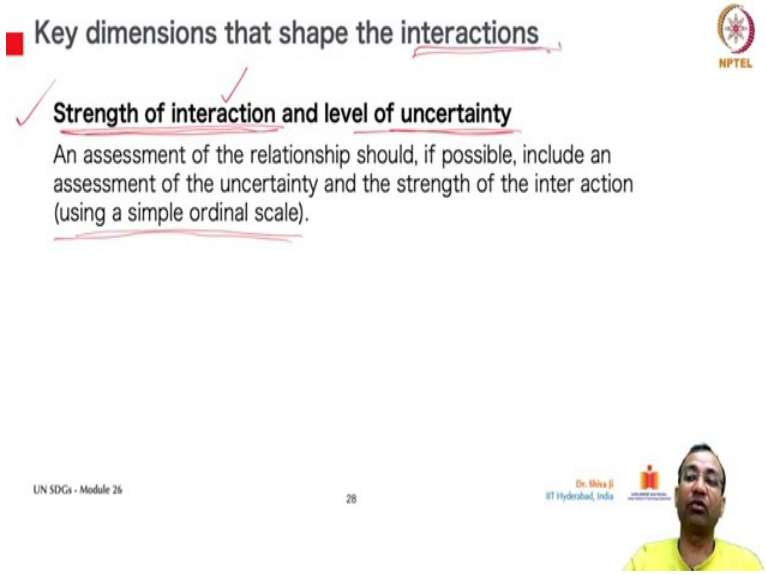

Then next key dimension here for interactions is strength of interaction and level of uncertainty. An assessment of the relationship should if possible include an assessment of the uncertainty and the strength of the interaction using a simple ordinal scale. So, you can understand it is very easy to understand over here, is no nothing complicated. Sometimes strength of interaction what degree of strength that interaction is actually having and the level of uncertainty how possible how often it is possible that interaction is going to occur or may not occur or occur to what extent and all and so on. So based on that interactions also may actually change or deviate.

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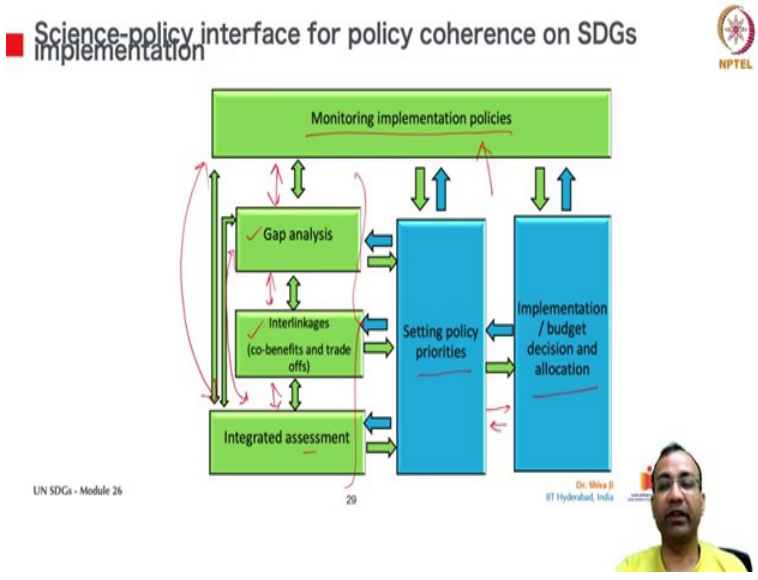

So, now we have come to this part where we are seeing this coherence science policy interface for policy coherence on SDGs implementation. So, how these SDGs are getting implemented so there are some monitoring implementation policies which actually help doing gap analysis which helps establishing interlinkages, synergies and trade-offs, co-benefits and trade-offs which gives inputs to integrated assessment.

And again from here it gives its feedback loop and it shapes that the previous stages also and you see this interaction is bi-directional here plus this also they have this special direct relationship also between these the layers. From here we are going on the side about setting policy priorities implementation slash budget decision and allocation. So, they also are having this the bi-directional relationship with these set often stages or at the top directly with the monitoring implementation policies.

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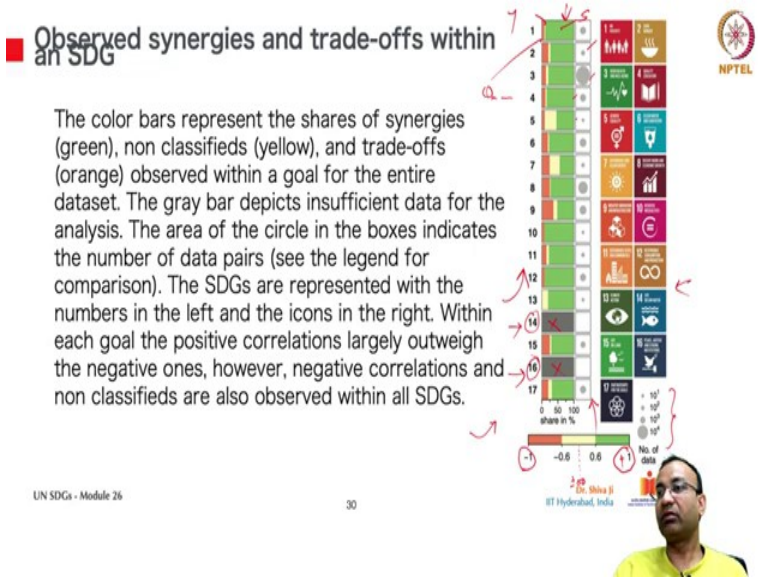

So, we will see some examples of synergies and trade-offs over here with some illustrations. So, here there is one observation for observed synergies and tradeoffs within an SDG. So, you can see this is the zone where it will be plus minus 0 0 level and here we are in the plus 1 side, here we are in the minus 1 side and then the whole range in between with the segment at plus 0.6 interval and on the left side at minus 0.6 in interval. So, dividing almost this band into 3 equal parts.

The color bars represent the shares of synergies shown by green so this is the synergy shown by green, non-classified in yellow and trade-offs in orange this observed within a goal for the entire data set. The grey bar depicts in sufficient data for the analysis here the 14 and 16 there

is no sufficient data available. The areas of the circle in the boxes indicate the number of data pairs.

You see this column, see the (())(31:25) for comparison. The SDGs are represented with the numbers in the left, these numbers. And the icons on the side these are the icons within each goal the positive correlations largely outweigh the negative ones. However, negative correlations and non-classifieds are also observed within all SDGs.

So, if you see mostly these SDGs are working in sync in synergy and that is why we see major share of greens in all of these SDGs but interestingly if you see yellow is also available, yellow is also present in most of these SDGs except 2 places 10th and 12th these yellow ones are also there in everyone except 14 and 16 where there is no data available so keeping this aside this is this graphical representation.

So, accordingly why this is essential to understand because you will see a lot of data, books and papers written on understanding these synergies and trade-offs and why is it essential that we have seen it earlier for multiple regions you need to know objectively to understand what is going on and what measures and initiatives can be taken up in future to word of all evil implants. The number of data is shown here you can see by this number the biggest this thing is more than 10 to the power 4.

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So, we will see some trade-offs and synergy pairs. Global ranking of SDG pairs with high shares of synergies on the left side and trade-offs on the right side from the top to bottom. SDG1 no poverty 3 good health and well-being and 6 clean water and sanitation dominate the

global top 10 pairs with synergies, the global top 10 pairs with trade-offs either consist of SDG12 or 15. So, you can see over here the such comparisons are quite common to make some implementation based research work.

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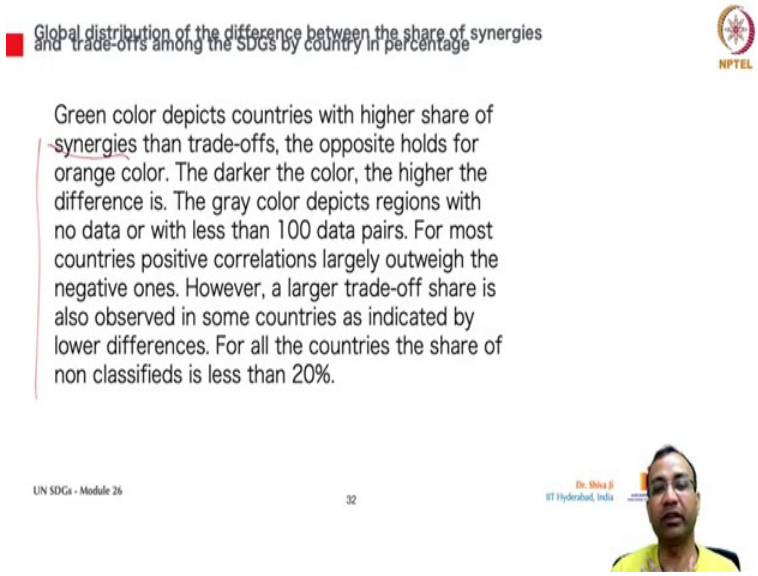

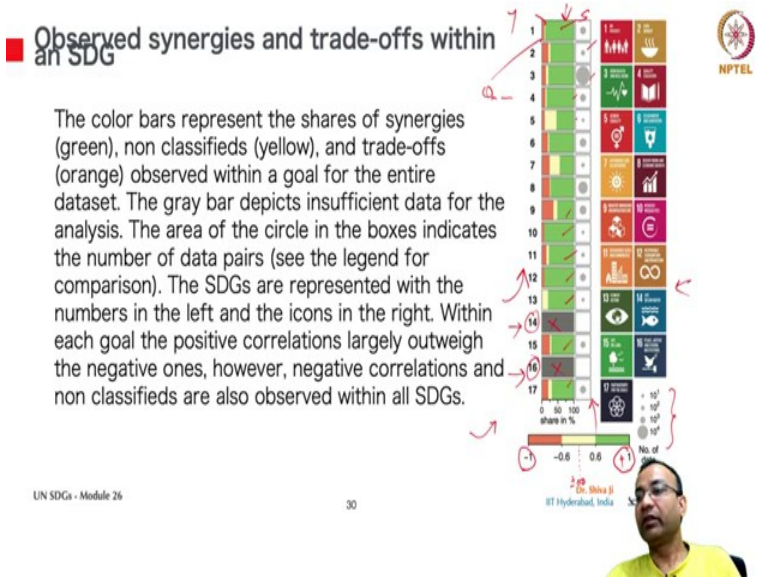

Global distribution of difference between share of synergies and trade-offs among the SDGs by country in percentage. Green color depicts countries with higher share of synergies than trade-offs, the positive holds for orange color, the darker the color the higher the differences. The grey color depicts regions with no data or with less than 100 data pairs. For most countries positive correlations largely outweigh the negative ones.

However, a large trade-off share is also observed in some countries as indicated by lower differences. For all the countries the share of non-classifieds is less than 20 percent. So, you can see green depicts higher share of synergies compared to the trade-offs previously also we saw in this illustration if you see from this first column there are more more greens over here.

So, just to inform everyone by top 10 synergies pairs if you see SDG 11 sustainable cities and communities there is a direct relationship between STG13 on climate action from first to fourth quality education. If your kids are educated there is a very high chance that they will settle up more comfortably and in a regular at least work or maybe entrepreneurial work so there is a direct correlation.

Next we have 1 and 5, no poverty to gender equality. In social level in many societies and places gender equality is still an issue women are not given with the proper rights or total rights of having their own life rather their life is kind of a very strangely put it does not helps rather if there is a more poverty, more issues on the gender equality kind of situation. Then there is a direct numerous energy between 1 and 10, no poverty to reduced inequalities.

Next we have no poverty to clean water and sanitation. So, if the person if the family is not from a well-to-do kind of a status wala family they are going to miss out on very basic

essential thing such as fresh water, portable water which is very crucial for our bodily engagements.

Next we have this direct synergy between quality education and reduced inequalities. Next we have about SDG 3rd and 10th so good health being and reduced inequalities. Next we have no poverty to health and well-being, if the person does not have anything to eat, how it is going to help maintaining a proper mental and physical health and well-being. Then also we have this synergy between SDG third and fifth, third and sixth.

The trade-offs where they are not helping but they are having some sort of a negative interaction of minus 1, minus 2, minus 3 levels. So, that is between in SDG12 and 10 and 12 reduced inequalities to responsible consumption and reduction. Because the moment you go for such initiative there will be a kind of a panicky situation and everybody might pose pressure on the consumption.

The next level of trade-offs we are seeing, no poverty and responsible consumption, where there is no supply of anything how about consumption, you need whatever you can afford, so responsible consumption and protection actually takes a little tall over here. 6th and 12th, 3rd and 12th, 4th and 12th, 10th and 15th, 5th and 12th, 1st to 15th, 2nd to 12th, 4th to 15. These are actually combinations where there is a trade-off so these are the top 10 of a synergy and tradeoffs.

Here we have global distribution of a difference between the shear of synergies and trade-offs among SDGs by country in percentage. Green color depicts countries with higher share of synergies than trade-offs, the opposite holds for orange color, the darker the color the higher the difference is.

The green color depicts regions with no data or with less than 100 data pairs for most countries positive correlations largely outweigh the negative ones. However, a larger trade-off share is also observed in some countries and is indicated by lower differences. For all the countries the share of non-classifieds is less than 20 percent.

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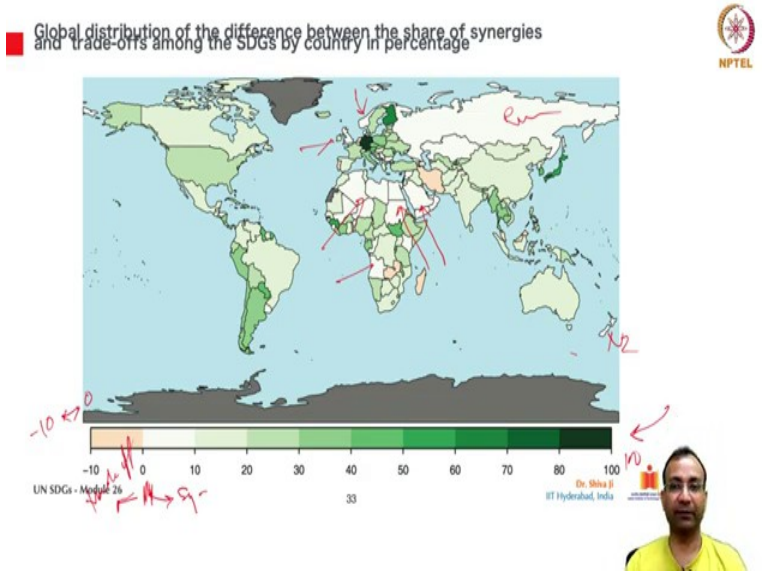

So, this is this figure you can see and this is this color band color legend you can see it is coming from 0, the level of synergies and trade-offs. So, this side we have in synergy, on this side we have trade-off. So, from 0 to up to 100 on this side and from on this trade-off side it is almost 0 to minus 10. So, most of the places, most of the countries across the world irrespective of which continent they come from you can see a lot of green shades, different shades lighter, darker, middle.

And some of the countries are showing in blank Russia here, New Zealand here and so some more, many from Africa, from Middle East, United Kingdom does not have. Some of these Nordic countries also they do not have this data.

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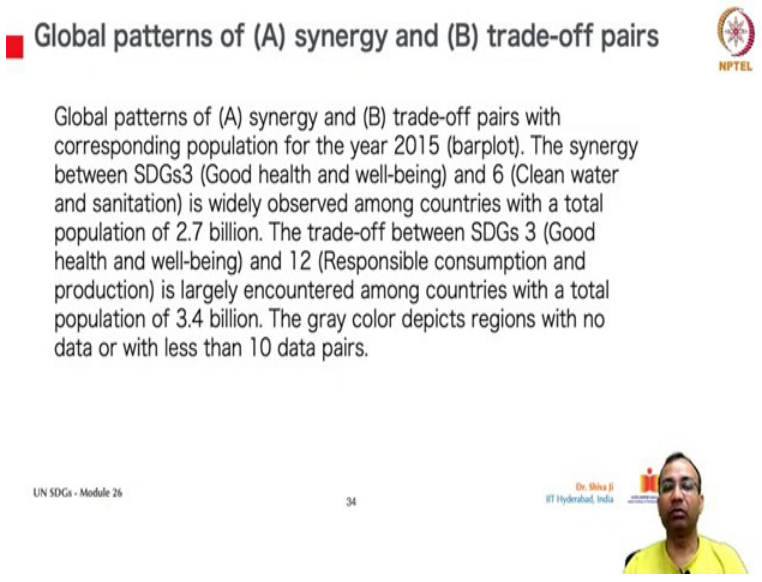

So, global patterns of synergy and trade-off pairs, global patterns of synergy and trade-off pairs with corresponding population for the year 2015 barplot. The synergy between SDGs3 will see this in the next slide, SDG3 good health and well-being and 6 clean water and sanitation is widely observed among countries with a total population of 2.7 billion. The trade-off between SDG3 and 12 is largely encountered among countries with a total population of 3.4 billion. The grey color depicts regions with no data or with less than 10 data pairs.

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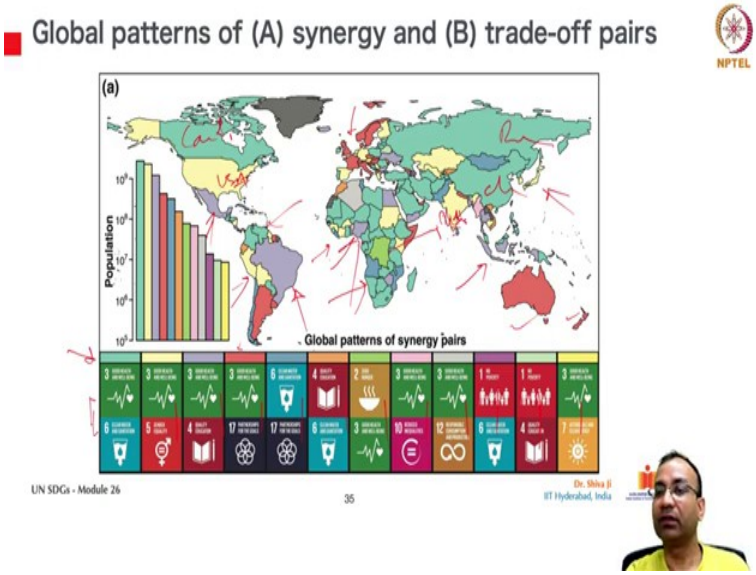

So, this is what we have here. So, you can see, so synergy pairs are given over here, these are the combos. So, good health and well-being you can see from this turquoise color with clean water and sanitation SDG3 and 6, so you will see this here in Canada, in Russia, even China and several in African countries some of this in Latin America also. Then yellow, light yellow represents good health and well-being with gender equality.

So, we are joined by United States of America, India and some of these Latin American countries, some here in Africa, Japan is also there in this list, and this light purple we have this third one good health and well-being with quality education. So, Brazil, Mexico and some European country and Indonesia. Then fourth one we have good health to partnership for the goal 17 depicted by this color. So, Australia, New Zealand, England, Norway.

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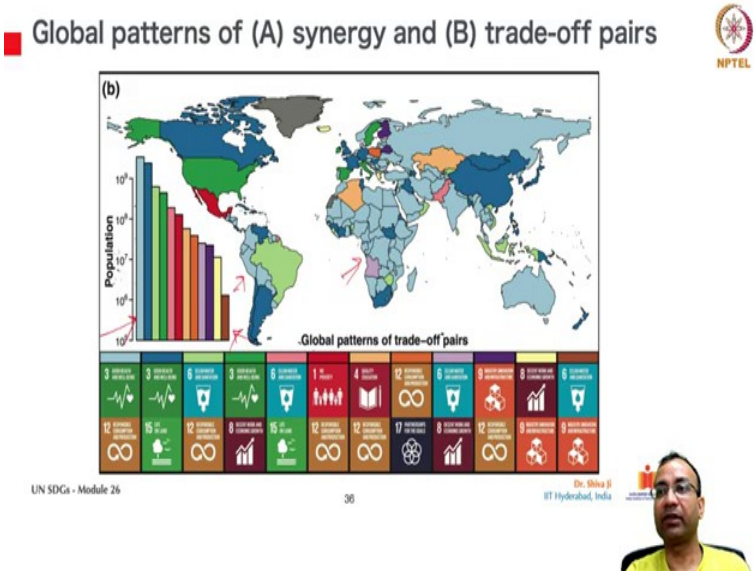

The next slide talks about synergy and trade-off pairs, so you can see. So, the first one light blue is majorly there in Asia and Africa and some in Europe, some here on this coast also, west coast of South Africa, South America sorry, and many others. So, from this actually color indicator you can see these different countries and what kind of synergies and trade-offs combination they have.

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So, now we are moving on to the next part that is SDG structure and order at levels of people SDG 1 to 10, ecological SDG 11 to 15 and spiritual SDG 16 to 17.