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DR. GAIN: So today we are going to talk about the evolution of water resources management. And at the end of the class, you will be able to describe paradigm shift and evolution of water resources management in general. But also, you can critically evaluate the importance of IWRM for water diplomacy, and also Water-Energy-Food nexus and its relation with water diplomacy, and also importance of water diplomacy for achieving sustainable development goals.

Today's talk is regarding a new process-- recent-- a process of water resources management and sustainable development goals and its relation with our water diplomacy. In this figure, I try to summarize taken from these references how the water resource management has evolved throughout the time. It has four metrics. You can see that from the centralized management to decentralized management in the vertical axis.

And from centralized management, it means the centralized form of governance where the stakeholder engagement and participation is-- the possibility of stakeholder engagement is very low. But when it moves to the decentralized form of governance, it can enclose stakeholder engagement from local peoples and local participations. And in the horizontal axis, you can see from the supply side management to the demand side management.

In the left upper corner, this is the traditional development of water resources management-- not only water resources management, any development started from this side. So it's highly centralized and supply side approach. So this is the first development pattern of water resources. So for example in this case, only option is to invest-- how to create dams, construction, reservoirs.

So this is the only consideration for the water resources management. And it's considered only engineering-based approach, and it's very technocratic approach without considering societal aspects or economic aspects-- mainly how to make the development and how the development pattern is start, and how the engineering structures can help to make the development effective. So this is the only consideration in this phase.

And then, so this is the position of A in the left-hand side upper corner. And but slowly, it moves from A to B. And in that case, from investment-oriented decision, it moves-- it takes consideration of the societal issues slowly. And then, so initial management paradigm considers mainly engineers, hydrologists, and technocrats.

But slowly, they can understand that this can create consequences to the society. And they can try to understand the demand of the local people slowly. And so, they try to incorporate the-- they try to realize that water is not only the development pattern or supply side management. It needs to consider also societal and economic aspect. And thus, the demand side options is started, and the demand side management is started.

And then slowly, it moves to the C. And in that case, institutional reformation start, or for example, decentralized form of governance institution. And yeah, so the-- from engineering-based structure of the management paradigm shift towards different disciplinary bodies in the management body, but also local engagement can also take place.

So this is the overall broader evolution of the water resources management happens internationally-- and also many countries. So here I can give an example how it happens in Bangladesh. Because I know this-- the context of Bangladesh water resources management-- how it happens throughout the time. So I can also explain the graph that I have shown and what happens practically in the Bangladesh case.

So before 1947, Bangladesh was part of the British colony. And during that time, there is no embankment to protect flooding in Bangladesh. So in that time, local people manage the embankment during the dry season to grow the crops. And in that case, landlords-- the British empire provide ownership to the landlord to manage a specific area of land. And to engaging local farmers, the landlords was responsible for managing flood protection embankments only during the dry season for growing crops.

But during rainy season, that embankment was, yeah-- vanished because of the rainfall. And the river water could enter into the flood plain. And it helps sedimentation. And it increases the yeah-- so land formation was happening during that time because sediment could come into the floodplain. And so this is kind of a natural process was maintained during that period.

But after 1947, the British colony ended. And there is no institution like the landlord management territory was not there. And since then, this part of land was part of Indian estate. So it was India and Pakistan was divided. And Bangladesh was part of the East Pakistan during that time. And so during that time, there is no responsible authority to managing the embankment or floodplain.

And during that time in 1954 and '55, there was a major flood events. And after that flood events, flood protection embankments was constructed in 1960s. And you see during that period heavy engineering works started. And in that case, the embankment protect the flooding from the river. But also it helps initially the agricultural production highly.

But slowly after a few years, this river carries a huge amount of sediment. And that sediment deposited in the flood plain, and that makes the land formation in the floodplain. But due to the embankment, this process was not taking place due to the construction of the embankment. And then the sedimentation was happening in the riverbed instead of the floodplain.

So the floodplain-- the land formation was not happening in the floodplain. But those sediment was deposited in the riverbed. And that increased the riverbed. And it reduces the navigability. At the same time, the internal water logging is started. So in 1980s, this whole area of floodplain becomes waterlogged. And permanent flooding was happening because of this construction of embankments.

So you see how the consequence started from the supply side approach considering only the narrow focus of the supply side process. So initially it helps in improving the agricultural production. But in the long run, it created a disaster to the local people. So local people understood this process. And they really understood what is happening there. So going against the government, they tried to cut the embankment and bring the river water inside the floodplain.

And this process they call this, is tidal river management in 1990s. So they tried to implement this process going against government process. And they tried to implement locally with self-organizing capacity. And they implemented it on floodplain. And they were successful. And they after two years, they were able to see the major impact, like navigability in the riverbed is increased.

And also the floodplain-- the sedimentation was happening in the floodplain. So then the government could also see the positive benefits. So then they tried to institutionalize this approach in the government approach. So you can see how the transformation or evolution happened in this context-- a similar explanation that I just gave in the previous slide, just to show how the evolution was happening.

I also tried to explain how a paradigm shift in water resources management happen through the literature provided by Claudia Pahl-Wostl. She's one of the experts on adaptive water resources management or integrated water resources management. And so, in her work she tried to categorize or explain different dimensions of water resources management from command and control approach to the integrated approach.

So in the governance dimensions that the major paradigm shift happened from centralized form of governance to the polycentric form of governance, which incorporates both integration of top-down and bottom-up approach. And also in terms of sectoral integration, in the case of command and control approach, in that case, the sectoral integration was not possible. And it creates policy conflicts.

But in the integrated form-- integrated and adaptive form of management, the cross-sectoral integration is possible. And that also integrates policy implementation. So in the case of scale of analysis and operation, this transboundary problems emerge when rivers or basins are exclusive scale of analysis and management. But in the integrated form of governance, the trans boundary issues addressed by multiple scale of analysis and management.

And in the case of information management, understanding fragmented by gaps and lack of integration or proprietary information sources. But in the case of integrated form of governance, this comprehensive understanding achieved by open shared information sources that fill gaps and facilitate integration. And there are also three other dimensions.

So as infrastructure, you can see that in the first cases, only the command and control approach massive centralized infrastructure design and engineering with structure is dominant. But in the case of integrative and adaptive water resources management, this incorporates a combination of centralized and decentralized diverse source of design and power delivery is very important.

And in terms of financial and risk management, this case is only structural protection. And these risks are considered. But in the case of integrated management, diversified financial resources are considered for by considering broad set of private and public financial instruments.

And important aspect is dealing with uncertainty. In the case of command and control approach, it is considered that uncertainty is considered as undesirable sign of incomplete knowledge. So they don't know what will happen and how to manage the uncertainty. And this will create major problem.

But adaptive and integrated management, the irreducible uncertainties are acceptable, and the adaptive approaches are taken how to deal with the future uncertain outcomes by considering different scenarios. For example, different perspectives are explicitly acknowledged. So here you can see difference between the two approaches from command and control to the integrated approach.

So now we would like to introduce one of the major paradigm shift and major dominant paradigm of water resource management, which is integrated water resources management. And of course, these pulls in the right-hand side characteristics that I have shown here. So integrative and integrated water resources management. Yeah, integrated water resources management is not new.

Although that is internationally conceptualized recently in the 20th century and at the end of the 20th century is introduced in the international arena. But there are ancient practices that incorporate-- integrated the major dimensions of integrated water resources management has been considered.

For example, in 9th century, Subak irrigation system in Bali is one of the ancient irrigation practices which practice this integrated water resources management. Of course, without knowing the concept, but they tried to incorporate the integration self-organization for managing the Bali irrigation systems through ancient practices.

Here, I wanted to share a video a very short video-- but you can find interesting how they were able to manage this Subak irrigation system in the Balinese agricultural practices. So let me share this. You can see how self-organization and cooperative water management has taken place since that ancient time. And not only the Subak system, but also there are other historical practices that incorporates this integrated form of resource management practices.

And other water resources management practices in Valencia, Spain, the multi-stakeholder participatory water tribunal have operated at least since 10th century. But also, the modern form of integrated water resources management was influenced mainly by Tennessee Valley Authority created in 1933 to holistically manage water resources.

So I don't know whether you are familiar with the Tennessee Valley Authority. Did-- some of you are familiar with this? Larry, do you know? I know some information, but probably you know better than me regarding the TVA form of management approach.

**PROFESSOR
SUSSKIND:**

Well, TVA wasn't just set up as a water management body. The Tennessee Valley Authority had enormous scope of development power and responsibility. And one of the few times in the United States where there was development across a large region, more than just a city or a metropolitan area. This covered much more of an area. And it attempted to give public management to infrastructure at a scale that the United States wasn't used to.

And as you point out, it was credited with being a planning mechanism. But given how anti-planning the United States has always been, I think it's more helpful to think about it as a development mechanism. And we had-- and still have-- but we had then lagging regions in terms of economic development.

And the strategy was, let's make a massive investment in a lagging region. Let's have all of the infrastructure-- roads that connect it to other places, water that it needs, electricity or hydropower that it needs-- let's have all of the infrastructure done simultaneously. And let's invest government funding at a large enough scale that it would then promote subsequent private investment and make it a sustainable place but with a much larger role for government-managed infrastructure.

That never took off as an idea. We don't see other regions of the United States where lagging areas were targeted by an economic development strategy that said, let's have a massive public investment in all of the infrastructure, job creation, training, and let's not worry about state and local government. And let's do it at a scale that turns around a lagging region. Because smaller scale efforts to turn around lagging regions don't work.

So the way to understand the TVA story-- and there are many books written about TVA-- longing for a regional publicly managed massive infrastructure project that would stimulate the economy in a way that wouldn't happen otherwise.

DR. GAIN: Yeah. Also, in the IWRM literature globally, this TVA approach is highly acknowledged. And it says that the TVA-like approach mushroomed all over the world for mainly agricultural development in the developing countries. So that culture has been practiced also in other places, and regional development plan through incorporating for example power generation, flood control, and how this integration happens.

And also the concept integration of multiple sectors in the IWRM also came from this TVA-like approach that is mentioned in the IWRM literature. Yeah, so before going to IWRM principles, maybe we can have a participatory discussion here. Why IWRM is important for water diplomacy in your opinion.

I wanted to make it a breakout group. But as we are only five people, so maybe we can discuss why in your opinion-- also there was a memo on this. So maybe we can discuss here why IWRM is important for water diplomacy.

PROFESSOR SUSSKIND: Well I guess first, do you think it is? What is it about integrated management of water resources that makes it an important element of dealing with trans-boundary waters?

GEMMA HOLT: This is a little bit of low-hanging fruit. But one of the readings observed that it's the dominant paradigm for water management globally. So it is therefore important to diplomacy. But I think one of the other things that stood out to me-- and I wrote a little bit about this in my memo-- is just efforts to move beyond diplomatic silos.

There was an example in the Liu et al. piece that really stood out to me about biofuels, and how the development of biofuels subsequently catalyzed or exacerbated existing problems with water and food scarcity. So the need for a more integrated management approach felt urgent and necessary as we move towards perhaps greater scarcity in certain water systems.

PROFESSOR SUSSKIND: But how would that work? Or theoretically, how might that work in context in which we do have siloed entities responsible for things like water? And if you say, well, integrated management is the key to managing water in the future so that you can connect water with energy, with food, with land? But that's not how those entities are set up.

Gemma Holt: Right. Yeah.

PROFESSOR Aren't we basically setting up systems to fail if we say that they have to be integrated in order to do water management when we know that they're not, therefore what are we hoping for?

GEMMA HOLT: That was a good question. I don't know if I have an immediate answer. I'll think about that though.

PROFESSOR I'm not sure there's a right answer.

SUSSKIND:

GEMMA HOLT: Yeah.

PROFESSOR It seems to me that from a planning perspective-- urban regional planning perspective, not a water perspective--
SUSSKIND: there's always an argument for centuries that the way to plan cities effectively is to start with a clean empty area and have a designer make a comprehensive integrated plan so that the land is used efficiently, so that all the uses are appropriately laid out and separate from each other when that's appropriate, and that you don't have to have holes in the plan where there's private ownership or other things that happen.

And you don't have to worry over time, because you just started building in one corner, and by the time it was done it was just a giant pattern of uncontrolled development. The idea has always been that you should plan whole cities in a comprehensive way. To me, IWRM has some of the same resonance.

Now we know, in real life there are very, very few planned cities where the whole city was laid out and all of its evolution was guided by or controlled by the original plan. And it's very hard to have in a democratic context, and one in which there's private land ownership, continuity with a single plan.

And even in some parts of the world where historically there were efforts to plan whole new capitals, whole new cities, where they brought in a famous architect who made a beautiful plan for the whole place, over decades the place changes from what the original design was for all kinds of reasons. Not the least of which is people want to have choice about what things are going to look like, and what they can do with what their land is, and what say they have in a democratic context.

So just for purposes of pursuing further the question that I asked you, Gemma, is do you imagine that people in a democratic context can live, and work, and build in a way that's comprehensive, integrated, and planned when all the forces of democracy, privatization, individuality, and all the unexpected things that happen organically pull in the opposite direction?

GEMMA HOLT: I mean, I think I have to say, yes, but that's my prerogative as a first semester urban planning student. If I've already given up on the field, then it may be too late for me. I think that some healthy skepticism isn't uncalled for, I guess. I mean, I don't know.

I guess what is resonant about IWRM, and the Water Nexus approach, and science policy interfaces more broadly as the potential to reimagine existing diplomatic regimes. But I don't know whether that actually will work in practice. So maybe it's just an intellectual exercise. But I think it's a useful intellectual exercise.

PROFESSOR But it's only useful if it inspires something in practice that can be done. Right?

SUSSKIND:

GEMMA HOLT: Yeah.

PROFESSOR SUSSKIND: It's not useful if it alludes to something in theory that can't be done in practice, and everybody's just thwarted and can't achieve what they're supposed to-- or the ideal. And just to loop back around again to urban planning, nobody in urban planning teaches about comprehensive planned cities anymore except as an intriguing historical artifact.

Nobody would imagine that you would build a place according to a plan at time one and expect at time two a decade, two decades, a century later, that the place is going to have anything to do with what that original plan was. And yet they still think there's planning going on. The planning is about the process of adaptation.

GEMMA HOLT: Yeah.

PROFESSOR SUSSKIND: The planning is to create the institutions to be able to modify what you're doing collectively. So it's still planning, it's just not planning to achieve a preordained comprehensive idea. And I would argue in the water realm, we ought to be worried about IWRM as an ideal.

Because it presumes there are institutions with the authority, the power, with the knowledge to integrate across all of these multiple dimensions, in spite of the fact that we have created the silos that you alluded to, and that there are contending interests trying to pursue and maximize different outcomes that are good from their standpoint. So for the reasons I worry about comprehensive planning-- I worry about IWRM.

DR. GAIN: So any other thoughts regarding IWRM?

FLORA KLISE: I think something related to what we were just talking about is the interesting fact that in some ways, the IWRM is very broad. But then in other ways, a lot of people criticize it for not being broad enough, saying that the adaptive water management system needs to replace or augment the IWRM, because that is moving toward that can we not only create water management, but can we make sure that this water management system is also going to be adaptable to the future. Because we have to assume that it's not constant.

When we look at these extreme weather patterns, or changes in the nature of a conflict, some of these IWRM management scenarios are just not actively trying to adapt and become better to adjust to these changes. So in a lot of ways, people are saying, oh, the IWRM is not enough. What about the Nexus? What about this adaptive water management system?

And so in my memo, I talked a lot about how I think one of the readings tried to analyze whether or not you could replace the IWRM. And I thought it was really interesting that they touched on the social value of the IWRM. It's taken a long time to be adopted, because a lot of the water policy water diplomacy sector is like, if well-respected water diplomats use a certain water management system, then it's more likely to be used somewhere else, not just I guess how some business models or other sectors might transfer a certain system.

So I just think that the IWRM's value, the fact that it is water-centric is, I think, very like a strength of the IWRM. And then the fact that in the Nexus water is not considered more valuable or important than these other sectors that you're considering in the Nexus, whether or not it's the Food Water Energy Nexus, where every sector needs to be treated equally.

I think the fact that the IWRM puts the water as the most important entity, even though it is maybe creating some boundaries that the Nexus wants to get rid of, I think is still really valuable. Because if you get too broad, it's hard to make any progress. But maybe I've misinterpreted. I don't know. It seems the future needs to be more understanding, and expansive, and multicentric. But also, how do we make progress if we can't get all those people to sit at the table and make an agreement in any regard?

DR. GAIN: Yeah. I think in terms of theoretical aspect, of course, the IWRM is very interesting. But in terms of practice, this is the main limitations, that to implement this theoretical framework in practice, this is highly criticized. And this implementation through following the actual process of the framework-- I haven't seen any studies that really went through the IWRM implementation.

So that is the main challenging thing that the implementation of IWRM is very difficult, and it's one of the unachieved goal of the IWRM. That's the main criticism. But in terms of the theoretical contribution that has been done, is I think is highly valuable at the broader level. But for implementing, it is kind of some kind of implementation oriented approach. That's how I see. Any thought around--

AUDIENCE: In practice, I mean I guess, in practice I guess you would hope that negotiators would have enough or be able to bring enough-- I mean, this is obviously very dependent on what the kind of initiating circumstances are of any negotiation-- but have enough flexibility to draw upon various frameworks as needed and as beneficial to a specific dispute, whether or not they call it IWRM or not.

The limitations of the IWRM whether it's in terms of scale or in terms of what's not included because of its water centric focus can be supplemented by drawing off of some of the other Nexus approaches as the others have said already, that if you are in the process of negotiating a dispute, you ideally should be able to pick and choose to an extent. And not be totally didactic about how you apply these frameworks.

But I guess, I don't know how you analyze it then if you're looking at it so holistically. But it's hard for me to imagine any one framework being able to wholly encompass all of the possibilities of a water dispute.

**PROFESSOR
SUSSKIND:** I think starting with a dispute is going to get you into a corner you don't need to be in. Start with the fact that you need to manage water. There's not a dispute. You just have water, and you have competing demands, and you have competing interests, and you have to manage the water. OK.

What would be a good way to manage the water? To involve entities with broad authority or multiple authorities, or narrow-- just water, to involve only the most expert people to make the decisions, or to engage the stakeholders affected by the decisions so there's support for whatever the decision is to go ahead with.

Would it make more sense to look just narrowly at the water that you have responsibility for, because you're within a political boundary, or would it make more sense to look at the water system moving underground or above ground that affects the water that you have responsibility for? Because the answers to those three kinds of questions almost always lead to people saying, broader, linked, more comprehensive, more participatory, more completely engaged, because it seems like a better way to manage water.

Now, assume there's a dispute within that water management system. How would you expect it to be resolved? Well, if you had pulled in all of those actors, and all of those interests, and all of that knowledge, and all of that authority to manage the water, and there was a dispute within that, you'd probably have to engage all of those same elements in sorting out a dispute that emerged. It would be hard to say, oh, there's a dispute. Now all of you who were involved in the planning of this and the management of this, go away. And the three of us will solve this.

It's not going to happen. So IWRM isn't a dispute resolution mechanism. IWRM is an approach to water management. And when disputes come up, it's all tangled up in the dispute resolution process because of what it took to do IWRM as the planning-- as the management scheme.

It was never meant to be a dispute resolution strategy or mechanism. But it's tangled up with efforts at dispute resolution. Because it's kind of hard to shrink any of the dimensions-- the parties, the interest, the scope of the problem, the institutional powers-- for purposes of resolving a dispute that's come up within the IWRM process.

AUDIENCE: Within models, I mean, could you differentiate and say the initial-- as you said, anyone who thinks through the three questions you asked is going to move out and say, broader, more inclusive, greater scope for this. Could you differentiate and say, OK, the initial water management considered negotiations will exist on this macro level and incorporate many different facets of the economy and secondary, tertiary effects of water management.

But then you say after that, you basically incorporate dispute resolution processes that are hyper-local, that are specific to the area where the resolution-- where the dispute is taking place, and don't require completely remapping all of the old terrain?

**PROFESSOR
SUSSKIND:** That historically, that's what the law and regulation have in fact done.

AUDIENCE: Gotcha.

**PROFESSOR
SUSSKIND:** We have a system of water rights that has nothing to do with IWRM. Just take California or take the Western United States. IWRM, you would plan that water in a certain way. But you can't in a system that's defined senior water rights, where people who got there first got the water. And nobody can tell them what to do with it. And they can waste it, they can do anything they want. It's completely contrary to the ideas of IWRM.

And until relatively recently, the whole water law around the world is not connected to water management. The rules of water law come down almost in the way, Aaron, you're describing. Just how can I localize this, and situate it in the way we deal with other property rights, and that's how we'll handle the dispute. But it doesn't fit with what we imagine is the broader scope, and the need to take account of more interests, and the desire to look at the interconnectedness of things, and the need to look ahead-- not back at who had what rights, but forward in terms of who has what needs. And yet we're stuck with it.

So again, IWRM is a water management approach. It's easy to see how it evolved. And it seems perfectly logical. And it doesn't offer an obvious or easy way of handling disputes over water within systems that are managed by IWRM. And if you just try to solve this water disputes in a purely legal fashion that determines who has what senior rights, and hey, that's it. It's property.

But that doesn't take account of water as a shared human resource or as a human right. And now, how do we solve disputes over the allocation of water? We can't use the property rights law. We need something else.

AUDIENCE: Yeah, that makes sense.

PROFESSOR And Animesh, how do you react to what I just said?

SUSSKIND:

DR. GAIN: Yeah, so in terms of relation with IWRM and water diplomacy, I see that IWRM says, according to IWRM principal or dimensions, water should be managed in a transboundary, or watershed, or ecological boundary. So in that case, I can see the relation with IWRM and water diplomacy. Because when I say that water should be managed in a watershed or transboundary scale, that means it definitely crosses boundary of ecological boundary with the political boundary.

And it can immediately create institutional mismatches. And that can be managed through a-- a water diplomacy approach. So there's how I can see a relation with IWRM. So I can see water diplomacy can be useful for the difficulties that have IWRM implementation can be somehow implemented through incorporating water diplomacy approach. That's how I feel the relation of IWRM and water diplomacy.

PROFESSOR Do you want to go to your next slide and look at the principles of IWRM explicitly in light of the general discussion we've had?

SUSSKIND:

DR. GAIN: Yeah. So these are just a historical perspective of IWRM. So according to-- so it is started from the UN conference on water in Mar del Plata in 1977. Then in 1992, Dublin conference, which is the main building block for developing the IWRM principles. And in this conference, these four principles have been considered. So the principle number one is the freshwater is finite and vulnerable resources essential to sustain life, development, and the environment.

So here you can compare the thinking of the water diplomacy. So it's completely opposite of the thinking of the Dublin principle or water diplomacy framework considered water is the flexible resource instead of finite and vulnerable resource. So how the conflicting situation can be considered as the cooperative thinking that can be a major shift of thinking in terms of principles of IWRM and water diplomacy.

So in terms of principle number two, water diplomacy and management should be based on a participatory approach involving users, planners, and policymakers at all levels. And another important principle is that women should be a part of the decision-making process, like prohibition, management, and safeguarding of water. Specifically considering the role of women in the developing country, how they are closely involved with the water resource management and services of the water resources.

And the fourth and final principle is that water has an economic value in all its components-- recognized as an economic resource. So these are the four principles of Dublin conference in 1992.

And then another event where IWRM was first established is Second World Water Forum and Ministerial Conference in The Hague, where it's considered that equity criteria along with subsidiary-- um, subsidies to poor. This is also considered as a principle of IWRM. And then it is declared in the International Conference on Freshwater in Bonn, 2001. And then World Summit on Sustainable Development in 2002.

So now, based on these principles, IWRM has been, as you can see from the global water partnership definition that IWRM is considered as a process which promotes the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner, and without compromising the sustainability of the vital ecosystems.

So it incorporates theoretically multiple aspects, like it is considered as a planning process, as Larry already mentioned, and it incorporates the coordinated development, like TVA kind of development pattern, which incorporates not only water resources, but also water and related resources that are linked with water can be managed together for maximizing the economic and social welfare with an equity basis of considering the sustainability of the ecosystems. So that is the broader definition of IWRM.

And probably, you have read in this criticism by Asit Biswas. And where he mainly criticized the Hague definition of integration, what issues needs to be integrated, and how it can be a process. And so, in terms of operational point of view, he identified this vagueness. And in terms of theory is fine. But in terms of implementation, how this can be applied in a given context-- this is completely vague. That's what his message is broadly regarding IWRM.

So we tried to identify main dimensions of IWRM. So these are the [INAUDIBLE] dimensions that in our studies that we try to identify. So first [INAUDIBLE] dimension is integrated management. And the second dimension is the river basin or watershed should be the special skill for managing water resources. And water governance or institutional mechanism for governing water is very important.

And involving a stakeholders and public participation is also one of the key dimensions of IWRM. And consideration of water as an economic good is an important consideration of IWRM. And also ensuring gender equity and social capital is one of the main dimensions. So these are the seven dimensions of the IWRM.

And here I can see as I was mentioning, that river basin as a spatial scale. And to implement this river basin for water resources management, it certainly creates conflict. And for managing that, water diplomacy can play an important role for managing water resources. For integrated management, there are criticisms that needs to be integrated. And that also depends on the specific context.

And a specific context by engaging stakeholders what issues needs to be integrated can be decided and can be considered in a negotiation table that can be part of the implementation part of IWRM through a water diplomacy approach. So that's how I consider that for implementing IWRM-- the criticism that has in the literature. Some of the criticism can be overcome when we consider the water diplomacy approach. That's just how I see. I don't know. Larry, what would be your opinion on the linkage between IWRM and water diplomacy?

**PROFESSOR
SUSSKIND:**

Well, I thought your description was very reasonable. I start with the problems in practice. And maybe that's why I'm less tolerant of some of the fuzziness and some of the ambiguity in IWRM the way it's been written about and the way it emerged. I mean, calling water an economic good leads to the notion that you should get the prices right if you want to protect the environment, if you want to protect the water.

But as soon as you start talking about getting the prices right, you're assuming water is a commodity. And if you think water should be a right, then the price is not relevant. And thinking of it as an economic good is not helpful. And some of you know I'm working on the problem of water shutoffs in American cities, where people who can't pay their bill for their water for a month or two have their water shut off.

Well, they can't pay their bill because they're out of work. And telling them they have to pay their bill isn't going to make it possible for them to pay their bill. And then the next thing that the water department does is it calls the Family Services department and says, take the children out of that home. There's no water there. It's not hygienic. So their kids are taken away. They still can't pay the bill.

And then the next thing that happens is the city puts-- sells the lien-- it's an economic instrument on the debt-- because the city needs money to pay to maintain the water system. And if people don't pay their bills, it doesn't have the money. It can't maintain the system. So it sells the debt to private moneylenders, who then come after the person on a daily basis and saying, not only do you owe us the \$900 from the last four months, now the interest rate-- and we've just increased it to 10% interest. They can't pay the debt, they can't pay the interest.

And then after a year the city says, we're going to sell your house to recoup the mounting debt. We have all kinds of cities in the United States where the water authority sells liens and forecloses on homes, all because people couldn't pay the fee for water because they lost their job. Now, we have laws that don't allow the electricity company to turn off electricity in the winter if you can't pay your bill, because the presumption is you'll die.

But we don't have comparable laws that say you can't shut off people's water. Now during COVID, very interestingly, we have had a moratorium on water shutoffs in some cities. Because now the presumption is, people have a good excuse for being unable to pay their bills. But before somehow, they didn't have an excuse, like they lost their job. This is all a function of thinking of water as an economic good.

What if we said, every residential property gets a certain minimum amount of water that you need to stay alive that doesn't cost anything. And then all the water above that, you pay a price relative to your ability to pay.

Well, we never had in the United States a system of water fees based on ability to pay until last year when Philadelphia passed the first municipal law saying that they wanted to move in a different direction and have people pay for some portion of their water relative to their ability to pay. And you can imagine the legal battle that's now ongoing about whether that's OK or not. But all of that stems from the idea that water is a commodity, and we should have to buy and sell it.

In Australia, when it saw that it was running out of water-- fresh water, and had all terrible forest fires and other difficulties-- bought as a government all the water rights in one state back from the owners at a prevailing price per hectare. And then it paid back the money by selling back the water rights but on a different basis to people to try to have greater equity in the availability of water.

So it built a whole system based on water as an economic good in order to address a common need. Where if we thought of water as a natural resource and as a common resource, pricing wouldn't be the focus. And we've tried to make a market out of everything in the Western capitalist countries. And so now we have problems of water being unavailable to different groups of people.

And I worry that IWRM is about maximizing water as an economic good. That's one of the seven principles or whatever that you had listed-- water is an economic good. And there are several of the principles I understand completely where they came from. But when I look in practice, the problem is we have underinvestment in the capital improvements necessary to get water to people that need it.

And there's not a way to solve that through integrated water resource management. That's a political, ethical, moral decision. So a lot of the conflicts, some of which don't rise to the level of a formal conflict because the poor, the disadvantaged, the marginalized don't have the political clout to make it a fight.

But in fact, there's a conflict with very large numbers of people in different parts of the world unable to get adequate water, because there's no way to pay the capital cost to build the desalination plant, to build the water movement system to get water from one place to another. So that's what I worry about IWRM causing conflict and not providing a pathway to resolution of conflicts given some of the principles it includes.

HUSNAIN

Yeah. I had a different perspective to what you just said. For example, if a poor person in my country doesn't have access to clean water, he's installing a hand pump or something at the cost of \$1,000 or something, it's an additional burden to his daily income. What if the state would have provided him a water supply network with a certain pricing, and the state had ensured that that water was clean enough to drink?

AFZAL:

For example, I in Pakistan can't drink water directly from tap. I'm not sure about drinking water directly from the tap. But here in my residence in Ithaca, I drink water directly from the tap. So by this, I'm saving money from the bottled water, and then I'm saving money for installing my own boiling system or pumping system.

So if the state provided me with clean water with certain price in which they are maintaining the infrastructure, which is lesser than the amount which I am spending back home on bottled water and boiling water cost, like [INAUDIBLE] or something like that, then don't you think that the approach would be much better-- the water pricing approach would be better in this scenario?

PROFESSOR

You're paying rent in Ithaca that includes water cost. And if you lived in Flint, Michigan, you would be paying not that much different rent, but you couldn't drink the water from the tap, because it's been allowed to become contaminated. And the city doesn't have the resources to rebuild the whole system. So we've pushed on to individuals the cost of getting water in some cities whether we've allowed the water to become contaminated.

SUSSKIND:

Maintaining clean water is, I would argue, a common cost not an individualized cost. While you can go buy water in bottles, we still expect the availability of clean water from the tap-- drinkable water that won't kill you-- to be a common cost. If it's a common cost, then we should collect taxes from everybody in a progressive way and take care of building the things that are common, like clean water system.

So I know-- I heard the comparison you're making. But I would argue both in Pakistan and in the United States, that responsibility of local government should be to provide drinkable water for people as a capital cost that's a collective cost.

And whether that cost is paid for from taxes, which could be collected in a progressive way, or fees, which typically are not collected in a progressive way-- they don't look at ability to pay-- I think we can have that debate about what's the fair way to collect the money. But once the money is collected, it should be used to get everybody a minimum amount of clean water. That's my argument.

DR. GAIN:

Yeah. And I think that also fits with the IWRM principle like social equity and yeah. So--

PROFESSOR

Well, basically--

SUSSKIND:

HUSNAIN And to add to your point, that I mean, if IWRM is a collective approach, it's not about governments only. It's about people also-- society, societal education. For example, if you're doing-- you just said-- used the word "contamination." Who is doing contamination? We are doing contamination. We are mixing sewage water with water. We are doing water taps. We are doing hole to the main water supply line to get more water for ourselves.

That is something related to the societal education. If we do not educate people that water should be treated as a precious resource, that it should not be contaminated, it's like a joint responsibility, not the responsibility of government only.

PROFESSOR I agree. I agree. You'll have to excuse me. I'm trying desperately to get the folks planning Glasgow to approach the problem in a different way than they did in Paris. And they have chosen this hour. At least I have a chance to talk to them. I'm not making any progress. This is the third try.

But I feel obliged-- if they just meet in Glasgow and do again what they did in Paris, we are doomed. And there has to be a different discussion. And there's a group of us who are trying to promote a different global discussion on this question. So I'm going to disappear. But the conversation about IWRM is important, because you need-- each of you-- needs to formulate-- to take a stand, to formulate an idea, of how you think water should be managed, and how you think disputes over the management of water should be resolved.

And I don't think either Animesh or I thinks we know all the answers. And I don't think there's only one solution for all places and all times. But we need to be thinking prescriptively. And if the best language we could say is, social needs are important. Common goods should be taken into account. Water should be managed in a comprehensive fashion.

Look at the linkage between water and everything else. I don't think that inspires action or policy. I think it's too vague. So I'm pushing you to think in more explicit prescriptive terms, and then to be able to argue for it-- for that view.

HUSNAIN And before you leave, can you just tell me the questions you are going to address in this meeting?
AFZAL:

PROFESSOR Yes. What should be done before the meeting by the people who will be coming to the meeting while they can still formulate new policy choices. Because once you're at the meeting, all you do is argue about the text that's been sent out. And every 197 delegations have been sent there with very explicit instructions by their country. There's no problem-solving that can happen at the meeting.

But before the meeting, everyone is busy figuring out what they want everybody else to do. There's no joint planning beforehand, because it can't be done in an official way. If it's done in an official way, then everybody's there reading the script from their country, saying everybody else is responsible, this is a problem, that's a problem-- nothing can happen.

So we're trying to get a different kind of conversation amongst a substantial number of the people who will be at the conference representing their countries into conversations between now and the summer-- not in their official capacity, just in terms of problem-solving. And not just technical, the others as well. But people say, well, how would you decide who participates?

And my argument is, it doesn't matter. They're not going to decide anything. They're just going to put forward good proposals. Let's just have a diverse group that wants to put forward proposals in the collective interest. Well, where would you have it? When would you have it? I said, it doesn't matter. We'd do it online. We just need to start work on new proposals of a different kind.

And the question that I'm saying that the proposals should be about-- what help does your country need to get to net zero by 2030? Not what's your responsibility for cutting stuff. What help do you say you need to get to net zero by 2030? And collect that, and look at the differences amongst what countries say they want and need. And then figure out how different countries can help each other work toward that as the goal.

2030 net zero, that's what we have to aim for. But now all we have is how much of the overrun will you agree to accept no matter what it costs you. And the answer is, you can't make me do it. And that's Paris. And we're going to get it again in Glasgow. So that's the conversation I'm trying to promote. Forgive me.

DR. GAIN: Yeah.

PROFESSOR SUSSKIND: I will see you all next week.

SUSSKIND:

DR. GAIN: [LAUGHS] So Mashroof, you wanted to say something? Maybe quickly, because we only have half an hour left.

MASHROOF HOSSAIN: [INAUDIBLE] that is I agree with Larry's argument that there should be a minimum amount of water for every household or every person, instead of putting them extreme pressure through the capitalist system. This is I completely agree.

But at the same time, in my country I've seen, and probably you have seen also, that when something is free, or whatever the amount that is, when something is free, most of the people-- and that is I have seen from my observation, and I'm sure that the research if anyone does it would give the same data-- that when something is free, there is a tendency to waste.

And in Bangladesh or in a developing country, a huge number of people-- they would be not that rich to afford it. So the government would be giving them a massive amount of water in total. And if everybody wastes just a little, or the majority of the people waste just a little, that's a huge amount of water being wasted, just because it's free.

And just because it's free, people do not value it that much. So I was thinking that how do we make a mechanism to stop that. Is there any mechanism at all? So that was my question.

DR. GAIN: Yeah. I think that in terms of IWRM, in principle the mechanism is there. So we need to place a price on the water. And yeah, one equity versus the price could be different for different group of people. And that can help efficiency of water use.

And just that is demand side management of water resources that is needed for increasing water use efficiency. So yeah, the mechanism is there in terms of theoretical aspect. But for implementing in Bangladesh or in specific countries is-- yeah, there are problems.

So maybe now we can discuss Water Energy and Food Nexus, the still we need to-- so Water Energy and Food Nexus. This is another important paradigm of water resources management. Sometimes it's called separate paradigm. But sometimes it's within integrated water resources management, where the integration was big in the IWRM.

And in this case, this central integration is explicitly mentioned. Like [INAUDIBLE] integration of water, energy, and food. But it could be also water, energy, food, climate, water, energy, climate, ecosystem. So it depends on the context.

But thinking of the Nexus is it comes from system integration. So how the global systems are interconnected, and how the traditional silo approaches is diminishing the importance of system level outcome. And that's why the Nexus concept came.

So for example, if I ask you what you have eaten in the breakfast, maybe a banana. And in that banana is not only food, but also it incorporates huge amount of water for producing the banana, but also transportation, and also from the agricultural field to coming into the food breakfast table, it consumes huge amount of energy. And if you don't-- if you waste that banana, then you can calculate how much energy and water has also been wasted from producing too.

So this kind of thinking is the Nexus thinking. So if you can increase the efficiency of water use in one sector, that can also helps increasing efficiency in the energy sector and also food sector. And that's how the Water Energy Food Nexus concept came, not only in the household perspective, not only in the urban aspect, but also in the transboundary water resources management aspect.

So the Nexus concept builds on many of this process. And it also incorporates this integrated process. But I already shared this article. Probably you have read this article. And it's interesting, because it clearly identifies the synergies and trade-offs of water resources management within Water Energy and Food Nexus, and how the incorporating Nexus thinking can help increase the efficiency of water resources management.

So for example, this Nexus thinking can uncover synergies and co-benefits. The example that is given in the London urine separation technology that helps reducing 10% of water needs reduction, but also eventually this also helps reducing energy use in water supply by 10% and wastewater treatment by 25%.

So by using simple urine separation technology, that this helps reducing water needs, energy needs, and wastewater treatment. But also it helps capturing nutrients. For example, 2,300 tons of phosphorus and 24,000 tons of nitrogen annually can be separated that can be utilized for producing a million tons of wheat in UK. So you can see how the synergies and co-benefits can be achieved by applying this Water Energy Food Nexus approach.

But also, it can detect harmful trade-off. For example, in Egypt and Spain, the water demand comparison is 75% higher than Spain in Egypt. But because in Egypt, it considers gravity-oriented irrigation system, which requires much water. But at the same time, the energy consumption is three times lower than the Spain.

Because in Spain, it considers not the gravity irrigation, but energy drip and drip irrigation systems. So if we convert the irrigation system in Egypt, then the water is saved. But at the same time, the energy and carbon dioxide production rate has increased significantly. So this kind of trade-off can be considered by considering this Nexus approach.

And also, I think Gemma was mentioning about the biofuels. And here is the example of biofuel, how the increased consumption of biofuel is promoted as an alternative of oil and gas. But at the same time, it can create huge amount of water scarcity and food sustainability in the United States, but also in the other countries. So the unexpected consequences can be taken into account by considering this Nexus approach.

So also in terms of integrated planning, and decision-making, and governance, this Water Energy Food Nexus is very important. Let's consider the transboundary aspect. So here in terms of Water Energy and Food Nexus in the transboundary context, if you see the relation between water and food. And for the food production, you must need water.

And in the upstream, water uses for the agriculture affects also in the downstream. And this can-- so the water and food are highly relevant in that transboundary context. But also, food affect water resources.

For example, it can through intensifying agricultural practices and land use changes by agricultural expansion, this can affect water quantity by changing the runoff. But also it can affect eutrophication and salinization and affects water quality. But at the same time, if you see the relation between water and energy, for the energy production, of course you need water. And energy production also affects water quality and quantity.

For example, the hydropower production for energy affects on water quality in terms of changing water temperature. And also, so the water temperature can change quickly by storing water in a dam. And that can also affect changing the water quality parameter. So you can see that these linkages are important for transboundary context.

In this study done by Keskinen et al, they tried to compare three transboundary areas in the Central Asia, mainly the Aral Sea, South Asian context, Ganges-Brahmaputra, and in the Mekong region-- the Mekong River basin. And they tried to qualitatively analyze this interrelation between the water, energy, and food. And the thickness of the line can determine how the relationship established, and what are the strength of the relationships are determined by the thickness of the line.

For example, in the case of Central Asia, the impact of food on water is highly important there. But also impact of energy production on downstream water flow is also important. In the case of South Asia, the impact of-- the importance of water on agricultural production between the upstream and downstream is very important.

So that's how they found. So this kind of qualitative relationships for water resources management within the Water Energy Food Nexus has been established. So in terms of how the Water Energy Food Nexus is important for water diplomacy.

So as you have seen, that the identifying synergies and trade-offs beyond water and river basin management [INAUDIBLE] is providing a scope for water diplomacy. But also the mutual benefit and promoting value creation-- the Water Energy Food Nexus gave a clear value added for water negotiation.

For example, hydropower-- linking hydropower, agricultural production, and water management can help saving-- that can help creating multiple benefits, and multiple co-benefits, and multiple value that helps water negotiation very easily. But also, Water Energy Food Nexus promote business idea.

And that can also link into the negotiation table, and can help reducing the conflict, and can create a cooperative environment. So these are the ideas that Water Energy Food Nexus can support promoting the water diplomacy. That's how I see it.

So here is a reference. I'll put them in the Canvas site. I found just recently, so I can share this article, so that you can have an understanding how Water Energy Food Nexus can be useful for water diplomacy. And also, how water diplomacy can help implementing Water Energy Food Nexus approach.

Just quickly, sustainable development goals-- the sustainable development goal has been considered in 2015 to meet the target by 2030. And in order to move from MDGs to SDGs, it considers 17 SDGs and with 169 targets. And SDG 6 is the ensuring availability and sustainable management of water and sanitation for all. And it incorporates SDG 6.5 that we need to implement IWRM through transboundary cooperation.

So the goal 6.5, or target 6.5 specifically on implementation of IWRM for cooperation incorporating transboundary cooperation. So here is the linkage of SDGs and IWRMs. But also the way IWRM is considered as an indicator, it is kind of-- there is criticism on this, because IWRM is very broader concept and theoretical concept. But the way that IWRM is considered as even sustainable goals, there is strong criticism on that. Because it considers very vague way of putting numbers on IWRM.

And how the measuring the progress is very debatable. But this is one of the major paradigm that internationally acknowledged. And that's why IWRM is very important. And also with relation to SDGs and water diplomacy, I see that many SDG goals are interlinked. And it can creates synergies and trade-offs.

So for example, if I can make one SDG target of, for example, renewable energy production. And for renewable energy production, is not specifically defined which kind of renewable energy can be produced. So that can promote the idea of hydroelectric electricity generation. So that can also affect implementation of IWRMs.

Because if you promote upstream water development projects for hydroelectricity, then this can affect relationship with the downstream countries. So these kind of synergies and trade-offs are very important. And that can be reduced, or that can be resolved through diplomacy approach broadly. So that's how I can see the link between the SDGs and the water diplomacy aspect in general.

So that's we wanted to discuss today classes. So first, we already discussed the evolution of water resources management, how it came from the supply side approach to the demand and decentralized approach with an example. But then, we already discussed IWRM and its importance in the international water resource management aspect, and its relation with the water diplomacy. But also, we discussed Water Energy Food Nexus and sustainable development goals, and its relation with water diplomacy.

Yes, so the next class will be the week after. And that class we'll play a role-play simulation, practically how we can resolve water conflicts. We'll play the game Indopotamia river basin management. And for the role-play simulation, we will need nine players. But we have six players.

So do you know is there any of your friend could be interested in the role-play simulation? If you don't find, I will try to find three other players. But if you have interesting colleagues that are highly interested to understand the role-play game, you can let me know. Yeah.

So another notice or announcement is that next week, Larry and me are going to talk on transboundary water resources management. Larry will discuss mainly the theoretical aspect. And I will describe the Brahmaputra River basin case. So if you are interested, you can join in this event. I can share the link for the presentation. It's the EU time. So it's the European time. So in US time, this would be 11 AM. Or yeah. So if you are interested, feel free to join in this event. Yeah.

Oh, another announcement-- sorry, I wanted to put it in here. There is a discussion paper on Water Energy and Food Nexus. And there is a discussion series is taking place by one of our colleague, who is the editor of the journal *Hydrological Sciences Journal*. And in that discussion paper, there is a topic on Water Energy and Food Nexus.

And people are interested, and if you feel is fit in your area of interest, there is a paper on water quality and Water Energy Food Nexus. And if you can criticize or comment on that paper, that can also be published if this is a concise and yeah, written in a scientific way.

So I can share that link if you are interested in participating this kind of writing. You can let me know. I have the linkage with the editor of that journal. So I can share with you if you are interested. So the writeup should be one or two pages, but it should be written in a scientific way. Yeah.

So I shared those two links. And also I will share the role-play simulation, what the general instruction, but also a confidential instruction for each player. I will share it with you in the next few days. Yeah. So bye.