Water Economics and Governance
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Lecture – 31
Economics of Water Projects

Hello everyone, so we are into the seventh week of this course and particularly on this session we are going to talk about the importance of economics in the evaluation and operation of water projects.

So, we have been earlier discussing that there are different aspects that one needs to consider in overall management of a water project. Which includes from the basics of societal important, point of societal point of views, then economic point of views, financial point of views, social point of views, engineering point of views?

So, there are varieties of aspects that needs to be taken care of and economic plays a very important, very key role in in overall management of a water project. So, we will be talking about some of the basics related to how the economic principles are used, in order to evaluation of water project, their feasibility analysis, their cost benefit analysis, their economic evaluation, which we will discuss the different methods of the budgeting into the next week; however, before that the basic concepts will be discussed in this session.

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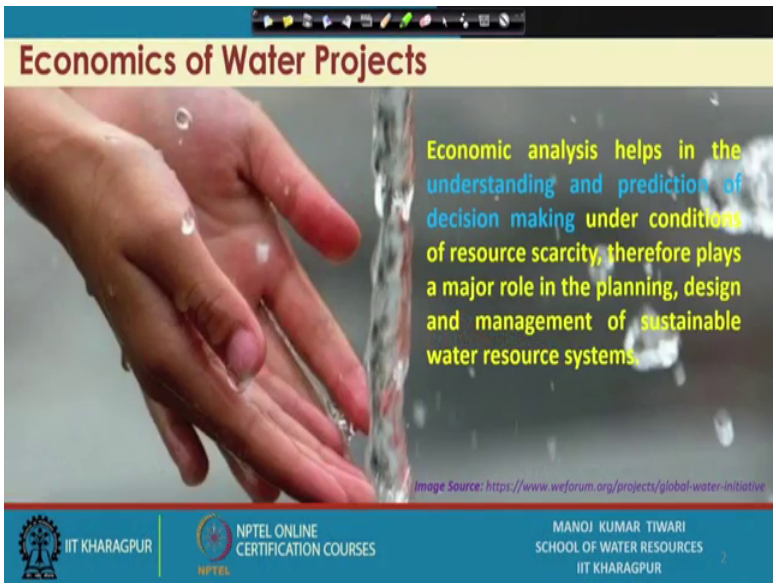

And continuing towards this whole week actually, so if we see the economic analysis primarily helps in the understanding and the prediction of decision making. This is very important because, when we start setting up of or conceptualizing a water project, which could be any water project, related to water resources management or related to water infrastructure development of a let us say urban water utilities.

So, any water project when we are sort of proposing a water project. So, the economic analysis is important in order to help us towards the understanding the financial implications of that project and in a way based on those implications support us for decision making.

So, particularly when there are let us say the resource scarcity issues. So, when there are resources are limited we are likely to have more environmental impacts more financial impact ok. So, in such scenarios the economic analysis plays a major role in planning, design and management of sustainable water resources system. Starting vary from the choosing the alternatives, which alternative could be useful in a given scenario.

So, for example, for a limited resource you have certain options for the allocation of that water resource, whether you leave it for the natural systems or for basic environmental uses or use it for municipal system, urban uses, send it to agriculture or send it to industrial applications or if you want to satisfy all these sectors. So, in what proportion these to be sent what are the different financial implications of diverting water from, let us say a river for industrial or agricultural use what is going to be the implication on the ecosystem.

So, quantifying that in the economic terms or what is going to be the financial implications of putting water into the agriculture or as opposed to let us say competitive use in the form of industrial applications. So, if one is going for industrial applications, what is going to be the net financial implications of this project or alternatively, if one is going for a agricultural application.

What is going to be the net financial implications of the activity? Starting from, what is the need of infrastructure? What is the need of capital investment? Then what kind of return is expected in terms of monetary values? Or what is the return expected in term of social benefit of industrial activity or alternatively agricultural activity? What is the net

return expected in term of environmental benefits? Or what is the net cost on to the environmental benefits as opposed to the alternative?

So, considering all these variety of alternatives, all these various alternatives it becomes very important to analyze critically, a rather critically analyze the system taking all sorts of different cost and all sorts of different returns and then evaluate whether my project is likely to be beneficial, or likely to have larger cost implications and lesser returns.

So, this kind of information is extracted through the economic analysis, it is not limited to just water sector. For any particular project such economic analysis helps in the evaluation of a project, similarly the concepts can be applied into the water sector as well; however, the issues with water sector are in a way different because in general, when you see the set you economics for a competitive market product, which is in the competition or which is not the lifeline need that way.

So, there the governing principle becomes different because it is just based on the market strategy in a competitive market, but in case of water projects we have additional environmental implications, additional social implications, water is such resource or commodity which is essential for the basic maintenance of life. So, the idea of getting greater returns on to the water services does not work here.

And that is why the implications of the economic analysis needs to be understood properly needs to be taken care of in very correct frame. So, that it does not intend to create any sort of social issue or social injustice in such scenarios.

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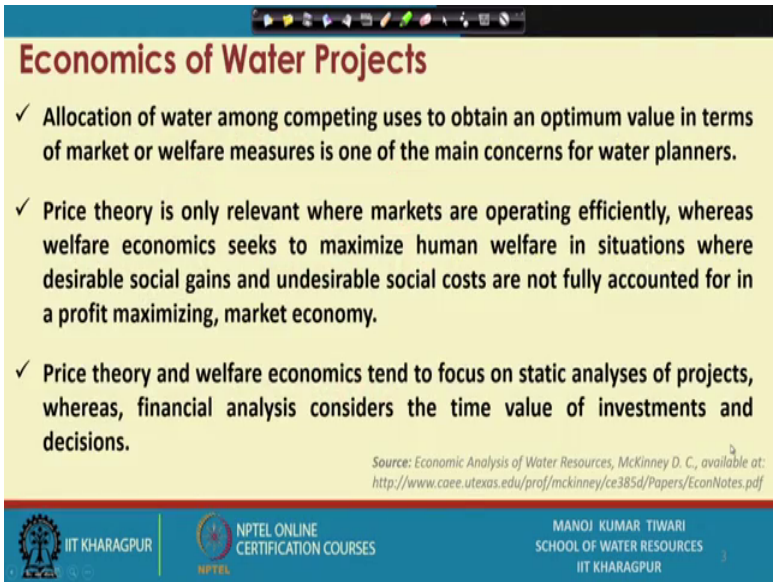

So, when we talk about the economics of water project. So, the allocation of water among various competing uses to obtain in sort of optimum value in terms of market, or welfare measure is one of the main concerns for water planners.

So, because that is the one of the very prime questions that planner face that how should one allocate it is water. Now of course, there is a social criteria that you will have to give a priority to the domestic sector first, because that is the water for the basic human needs.

So, that has to be given priority, but for the additional water or even in the domestic sector how to prioritize the sector, how much demand should be fulfilled from the domestic sector, because domestic sector demand also varies, now whether you should allocate 100 liters per capita per day of water, or 200 liters or three 100 liters.

So, those kind of allocation issues are there in the domestic sector as well, for all other competing uses where the there is a competition for the water, whether you should give it to agriculture sector or to industrial sector or to environmental uses recreational uses.

So, for all other competing uses, how an optimum value in terms of market or welfare measures can be obtained needs to be properly analyzed. So, typically price theory is the one which is used to analyze, the net gain or net price of a product in open market.

However, as we were discussed just discussing that price theory may not be that appropriate for water allocation issues, because it is only relevant where markets are

operating efficiently, where welfare economics is used to maximize human welfare in situations, and the desirable social gains and undesirable social costs are not fully accounted for.

So, those kinds of issues may appear very frequently in the water sector. So, therefore, the price theory or the welfare economics, which is which works towards the maximizing human welfare by optimizing the social gain and social cost. So, those kind of economics tend to focus on static analysis of project whereas, when we say the financial analysis of a water project. So, we should consider the time value of investments and decision.

Because the investment made today, for how long it is giving the benefit or what is the cost it is imparting in future is cannot be compared with the benefits and cost of today's time. The we know that the time value of money changes, the net gain of a 1000 rupees today, and net gain of a 1000 rupees after 10 year are not actually equal gains, because that time the value of money would be reduced.

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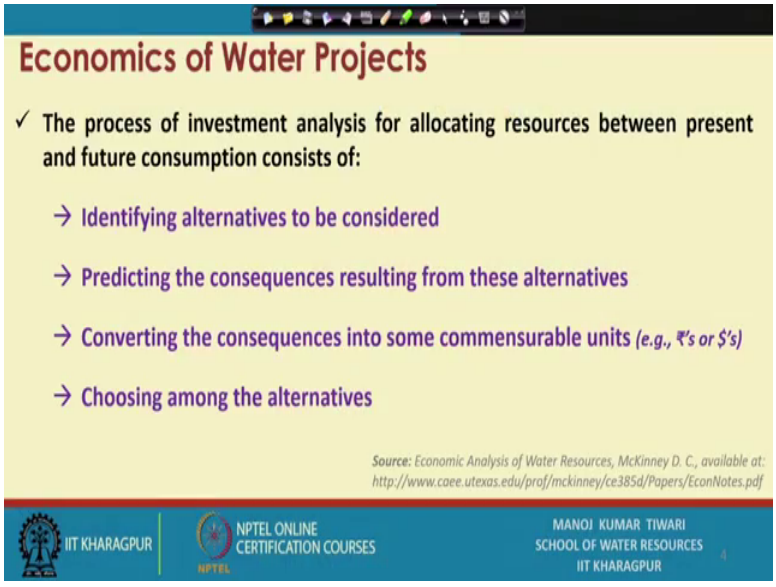

So, the process of investment analysis for allocating resources between present and future consumption, needs to be understood properly and it primarily consists of identifying the alternative to be considered.

So, when one is going for an investment analysis for allocating resource, like how where I should allocate my resource and how much investment or where I should invest for

infrastructure or for my project. Depends on clearly identifying the, what are the different alternatives that needs to be considered then predicting the consequences resulted from these alternatives.

So, if let us say I have three approaches, I have alternative a where I can allocate. Let us say I can allocate 500 cubic meter water for the irrigation purpose, I have alternative b where I allocate 300 cubic meter water for irrigation period and 200 for industrial.

So, then between these two alternative for example, one needs to basically predict what is going to be the consequences resulting from my these different allocation scenarios, what is going to be the consequence if I allocate all my water available or all my additional water available to just agriculture sector and I ignore the industries.

So, what are the consequences in terms of what are the net gains in the agriculture sector? What are the gains in the societal values? And what are the losses in terms of industrial growth or those systems, and what are the attached losses in terms of social welfare by restricting the industrial growth. So, eventually the pluses and minus for all alternatives has to be predicted.

Now converting these consequences into some quantifiable units, into some tangible units this is the very important step and. In fact, the probably the most difficult step in the economic analysis of water projects. Why it is most difficult? Because, when we are saying the consequences, let us say again consider option a is diverting my all additional available water for agriculture sector, and option b partly to agriculture sector and partly to industrial sectors.

So, when we go on comparing the particularly the social benefits. So, what are the benefits that are going to come from the agriculture, when we allocate entire water to the agriculture sector of course, there are going to be the larger area irrigated there is going to be the larger grain production and larger value of the crop, which is being produced which one can easily quantify, but additionally what is going to be the social gains ok.

Social gains in terms of how many more people are sort of employed in agriculture, that way how many more people are earning their livelihood from that, how many more people are whose life is based on that additional activity. So, what kind of eventual social development it is bringing is another benefit probably, but it is very difficult to quantify

that in terms of monetary values in terms of rupees or in terms of dollar how one would be quantifying that.

Similarly, for other alternative we have an alternative b for the alternative b, what if I am getting some water for the industrial growth. So, how many people are employed in that what is the net impact on their social lives. What is the net let us say increase in land value due to that, industry coming in at a particular place. What is the harm to the environment in terms of the industrial discharges or affluent?

So, in our overall lifecycle of this if one see, so there are going to be various benefits as well as various cost, which probably will not be in the defined units, and when something is not defined units, it is very difficult to account it, when we are discussing about the economics of water projects or economics of a project.

So, it is it becomes very essential to account for all the benefits and cost. Like we discussed in the last week, when we are talking about the or a week before, when we are talking about the valuation of water. So, there are environmental externalities there are financial externalities. So, how to quantify those externalities and has to be a mechanism developed to quantify those externalities and as they we took an example also if you recall that in the irrigation, how what are the net present value.

So, those values eventually were converted into a monetary value for that particular problem it was in the rupees. So, here also the consequence of choosing an alternative is to be converted in terms of a quantifiable in terms of a considerable unit. So, either it is rupees or dollars or bonds in some sort of quantitative form it has to be converted, where it can be accounted for.

And then once we did this exercise, once we have evaluated the different alternatives predicting their consequences, and converting them into certain specific units we get this freedom of choosing among the alternatives. Which alternative is going to be better for economic aspects, for economic sustainability or for financial returns or for net social benefits?

So, based on my particular objective I can choose then which alternative to choose for based on this economic analysis. So, water projects may vary in output depending on its

type and timescale. Now there are different types of output, one project may produce one type of output, while another project may produce another kind of output.

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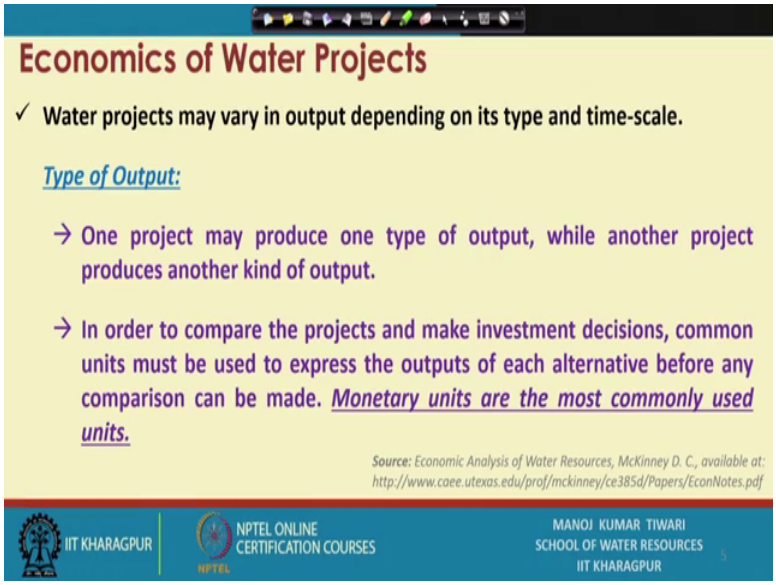

And in order to compare the projects and make investment decisions, the common units must be expressed or common units must be used or to express the output, for each alternative before any comparison is made. And monetary units are the most commonly used units as we were discussing.

So, you have one project in that is which is produced giving you some industrial product, industrial growth or those kind of development, the associated cost are in terms of environmental pollution. Whereas, you have another project agriculture related which has altogether different type of gains, that would be for the social welfare of a village where are where industrial activity could be sort of urbanization of a village.

So, there implications are different, their output could be kind there could be different kind of output for example, one is creating pollution. So, that is one of the output of course, negative output while other is sort of managing this soil, or restoring the soil productivity or such output could be expected from agricultural activity at times.

So, because the nature of the outputs are different, so as just we were discussing that when these nature of these outputs are different, it is very difficult to compare such outputs, and in order to do that we have to make them express in a single type of unit.

Where they can be compared, and monetary units like dollar, rupees, pounds, are generally used for such purpose. Then there is a time scale of output, where some projects will provide output in very near future and other projects may delay output for an appreciable time, or distribute the outputs for a long period which is your project lifetime.

Now, the output today will not have the same value as output tomorrow. So, it becomes very important to analyze the output in the time frame of prospective as well, as we were giving the example that water diverting for agriculture, will give you an will start giving you an output maybe after one crop cycle.

While water diverted for industrial production may start giving you output, if industries under manufacturing and it take, let us say 4 or 5 years to construct or to build the industry or those sorts of things. So, it could be a very time consuming process or alternatively if it is a running industry it can use that water and produce the product in terms of output or certain sort of benefits, right maybe within a few days ok.

So, at one place you have a timescale of months, at one place you have a timescale of days. This is still small gap, but many times many allocation projects particularly with the natural resources putting a canal, diverting a system, water supply system. So, in such systems you may see that output is slowly, and slowly, and slowly coming for the entire life time of the activity, which could be 20 years, 30y years, 40 or 50 years.

So, the outputs are distributed in such fashion, there could be additional cost also that would be distributed intermittently. Like what is the cost, would be the o and m cost needed today the operational management cost needed today, and the operation and management cost needed down the line 10 years, who is going to be probably different.

So, this time value of money also needs to be considered, also needs to be incorporated while considering the comparison of the different alternatives. So, choices is governed by the economic and financial feasibility and acceptability with respect to the social as well as environmental impacts. So, what kind of social impact or what kind of environmental impact the activity is going to create, needs to be analyzed properly.

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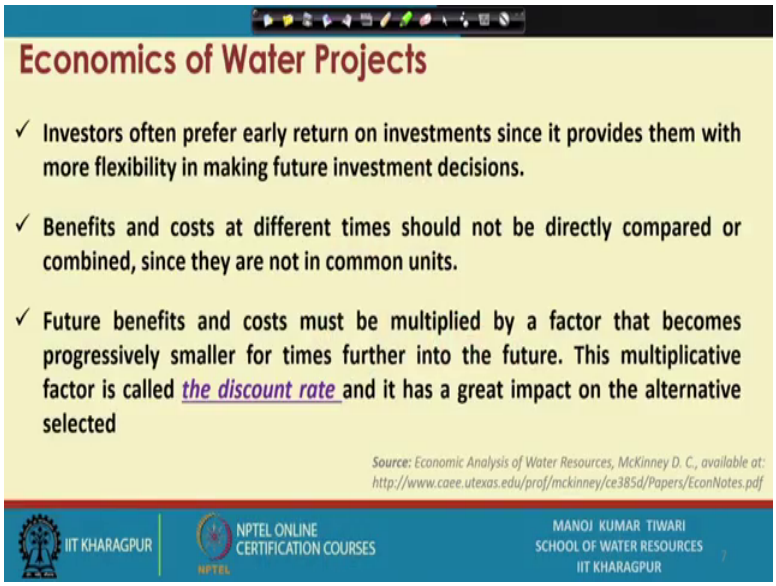

Investors generally prefer early return on their investment, because from the business prospective. If I am investing in certain business I would like to get my money back or get the return as early as possible. So, that is the common mentality of investors and since it provides them more flexibility in making future investment decisions.

So, if I have invested in a project, I am getting money after let us say 20 years with the slow return, it may be equally profitable for me, but if I am getting the return in 2 years, I would have that flexibility to make further investment or use that money for in some further business, instead of using that money getting hold for it.

So, the for this particular reason it is preferred by investors to seek early return on their investment. So, benefit and cost at different time are not directly compared or combined, because they are not in common units, common units in a way that lets say as I said that, it could be even if it is a common unit, the 1000 rupees benefit today, is has a much more value than a 1000 rupees benefit in 20, 50.

Although unit might be the same, but because of the time changes in the time value of the money it is not going to be the same. So, future benefits and cost must be multiplied by a factor that becomes progressively smaller for times further into the future. So, the factor would become progressively smaller for example, the 1000 rupees today, if I say that after 5 years, the 1000 rupees after 5 years, I need to probably multiply that by a factor of let us say 0.8.

So, that 1000 rupees after 5 years, may have a value equal to 800 rupees of today, if I am seeing that in a present time. So, 1000 rupees of we are in say 20, 18. So, 1000 rupees of 20, 18 is or let us say 1000 rupees of 20, 23, would probably be equal to 800 rupees of 20, 18, but if we go further to 20, 28, down the line 10 years.

That factor the 0.8 factor which we have used is going to be further smaller it may actually get down to let us say 0.6. So, 1000 rupees in 20, 18 sorry, 20, 28 is likely to be equal to 600 rupees of today's. Similarly, if we go on further into the future this multiplication factor will get smaller and smaller, because similarly you see that the 1000 rupees of today and compare the may be 100 rupees of 19, 80, they would probably have the similar values. What you could have buying one 100 rupees in 19, 80 you would not be able to buy probably that in 1000 rupees.

In today's time, because the 1000 rupees of today if you convert it to back then it might have lesser value than the 100 rupees of that age. So, this concept or this multiplication factor is called the discount rate, and it has a great impact on alternative selected. Because depending on the different discount rate it will be decided to which discount rate to like the how the benefits or future benefits are going to be the evaluated in today's monetary terms.

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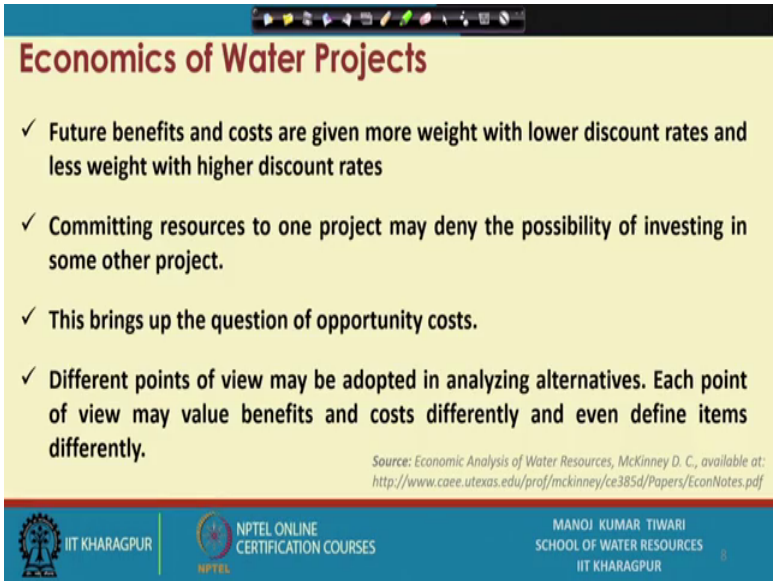

So, future benefits and costs are given more weight with lower discount rates and less weight age with higher discount rate. So, if discount rates are lower so; that means, their

weightage is higher and if their discount rate is higher; that means, their weightage is lower.

So, committing resource to one project may deny the possibility of investing in some other project. We have earlier discussed the opportunity cost concept, where the water which is being used for a particular activity, what are the alternatives available for which it could have been used that defines its opportunity cost ok.

So, similarly when we are committing the water for one particular project, we are denying the possibility of investing water or investing resources into the other projects. So, what is going to be the additional opportunity cost for that? So, we earlier discussed the concept of opportunity cost and that also plays a very crucial role in overall quantification of the benefits and gains.

So, different point of view may be adopted in analyzing the alternative because when you see these opportunity cost and such things are done based on a hypothetical scenarios. What I am expecting today, what is my estimation today may not actually be the estimation of somebody else for the same project. The opportunity cost, or the other uses are estimated based on the hypothetical principles, hypothetical concepts.

So, there could be difference in the point of views as well, each point of view may value benefit and cost differently. And even like define items also differently the input items could be different for me. I am evaluating a possible industrial use the inputs that I am taking for industrial use, what are the net products? What are the social gains? What are the environmental harms? What are the climates changes happening through that.

So, if like how holistically, I am considering the lifecycle of that particular activity in my opinion, somebody else doing similar analysis may use of course, some units are going to be the common. But may have a different approach of analysis altogether and may use different inputs for analysis purpose. So, his inputs not necessarily are going to be same he may have different set of inputs.

Now when I say different set its not its go ahead it may not be that its entirely different, but there may be some additional inputs in his opinion, which are not there in my list or there might be some missing inputs in his list, which are included in my list. So, those kind of differences in the open are also there and this in totality can skew, the analysis of

other alternative options are based on how we are hypothesizing the opportunity cost for a particular resource. So, we will end this session here and continue the further discussions into the next session.

Thank you.