**Introduction to Environmental Economics**
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**Lecture – 25**
**Benefit – Cost Analysis and the Environment – II**

Hello everyone. So, this class is a continuation from the earlier class. So, we are continuing with the same topic Benefit Cost Analysis. In the last class, we discussed about the definition of benefit cost analysis, then we discussed what are the rationality and background, the historical background and the theoretical underpinnings of benefit cost analysis. We also understood what are the basic concepts that we are using in order to understand this benefit cost analysis.

So, today we will be discussing what are the major steps that are necessary in conducting this benefit cost analysis, along with what are the key challenges or issues in estimating the benefit costs aspects. And we will also be focusing what are the developments new developments, recent developments in the benefit cost analysis and also we will be talking about the taxonomy of values and non-market valuation approaches, ok.

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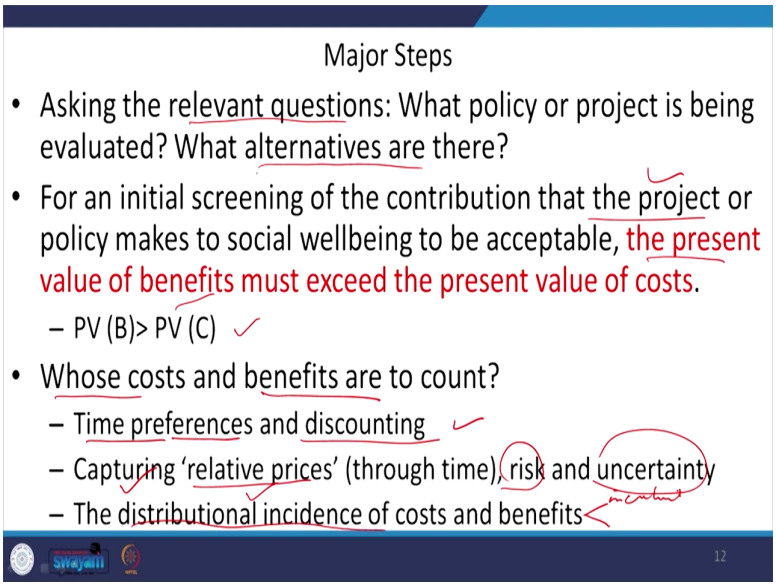


So, now let us have a look that if we have to apply it or factorize it then what will be the major step we need to follow for the same. So, for the practical applications of the benefit cost analysis, we need to follow certain steps like we must for the first one; we need to see that whether a particular policy or project in discussions that is to be evaluated, whether it is really needed at this point of time. And if you are saying that yes it is badly needed because of certain issues that are encountered, then we need to explore what are the alternative options are there in order to tackle the same problem. So, asking the relevant questions are necessary for the first step of the benefit cost analysis.

And again; so, for the project particular project is concerned and we know that this project will be acceptable if the present value of all the benefits each greater than the present value of all the costs. So, that is why we need to take into account all the alternative scenarios, the present value of x alternative, y alternative, z alternative then present value of the costs of

these 3 alternatives. And if for a particular project if the present value of benefits is greater than the present value of cost, then obviously we can think about accepting that particular proposal.

So, after doing this first step exercise that purging right kind of questions are necessary, the second step would be whose cost and whose benefits are to be taken in to account for a particular policy or particular program. So, if you are thinking about to have a particular policy to tackle the air pollution in Delhi and you are taking to account the costs and benefits the people are getting or losing in Bangalore, then obviously it is you are doing a wrong thing, wrong calculation.

So, in this context those people who are the party of party to that particular program or policy, they must be taken into account and their cost and benefits are to be taken into account. And more about, who are to who are to who will be incurring the costs are getting the benefits whether this is this generations or it will be actually or present generations or present time those who are existing or after 30 years also whose whosever will be coming they will be also equally getting this the costs and the benefits. So, that costs also will be taken into account in order to consider the total or aggregate costs and aggregate benefits.

So, that means, in this question that whose costs and whose benefits we are not only treating we are not only taking into account, the cost and benefits that are experienced by the present generations, but also the future generations or you can say whosoever will be coming depending upon the impact of that particular project across the time. So, that is how we are saying, we are using this discounting factor in order to solve this problem.

And the second thing that we are also taking into account in addressing this question is we are capturing the relative prices. So, because we are talking about this present and future time and time and time dimension like to first year second year or to let us say 20 year. So, that is why we need to take the relative time addressing the risk as well as uncertainty because costs and benefits are present, it is not suffering from any kind of risk or un uncertainty. So, it is less risk, it is prone to less risk and less uncertain.

But when you are actually speaking about after 5 years, we will be getting some kind of benefit because of this project then it is uncertain. You do not know what will happen after 5 years, so that is why this kind of costs and benefits that is accrued and that is spread over like future time, so these are very risky and uncertain affairs. So, that is why capturing the relative price is necessary.

And the third one is in this context that who is whose cost and whose benefits are to be estimated. We need to take into account the distributional incidence of costs and benefits. What is distributional incidence? That means, who are getting the benefits and who are getting the costs and their income level whether they are less privileged or whether they are wealthy. So, depending upon who is getting the incidence of this costs and incidents of the benefits of that particular policy, we need to see it.

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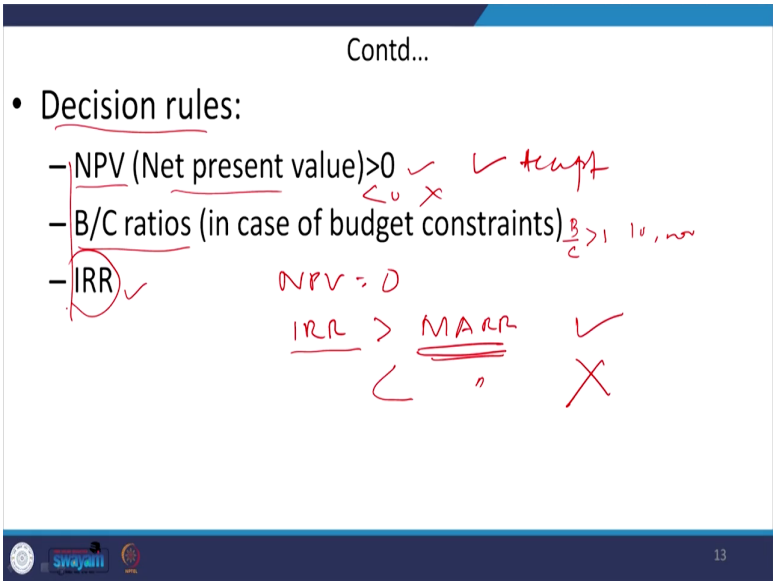

So, after doing all this exercise now we can have a decision rule. So, what are this decision rule we can follow, that whether the project or the policy will be accepted or rejected. So, it we can apply for taking this decision rules making this decision rules, we can take the help of the NPV criteria. This is known as the net present value criteria that means, we are converting all the benefits and all the costs into the present time. So, the best here would be now 0.

So, if this net present value is greater than 0, then we are saying accept the project or accept the policy for implementation. If it is less than 0 then obviously, where out rightly rejecting it and if it is equal to 0 then you are indifferent you need to relook the factors responsible for this ah for this benefits and costs. We need to relook.

So, another criteria that we can also follow in making the decision that whether to accept the policy or reject, it is benefit cost analysis. So, why again? So, if there is a budget constraint, let us say the funds for this is let us say 10000 rupees. Then for accepting it accepting the policy then we need to see that this B by C ratio it should be greater than 0 that means, the benefits should be greater than 0. And the third criteria that we can also use in making this decision rule its internal rate of return. So, what is this internal rate of return?

So, internal rate of return is defined as the discount rate at which this net present value becomes 0. If IRR is greater than this minimum acceptable rate of return which is the minimum beyond which this particular return or this particular project is not feasible, then we are saying if IRR of a project is greater than the minimum acceptable rate of return. We are saying that project should be accepted or approved. And if it is less than this MARR, then obviously this should be the project or the policy should be rejected.

So, based on these three criteria, we can also the policymakers they can decide that whether to go with the project or the proposal or policy or not to go it.

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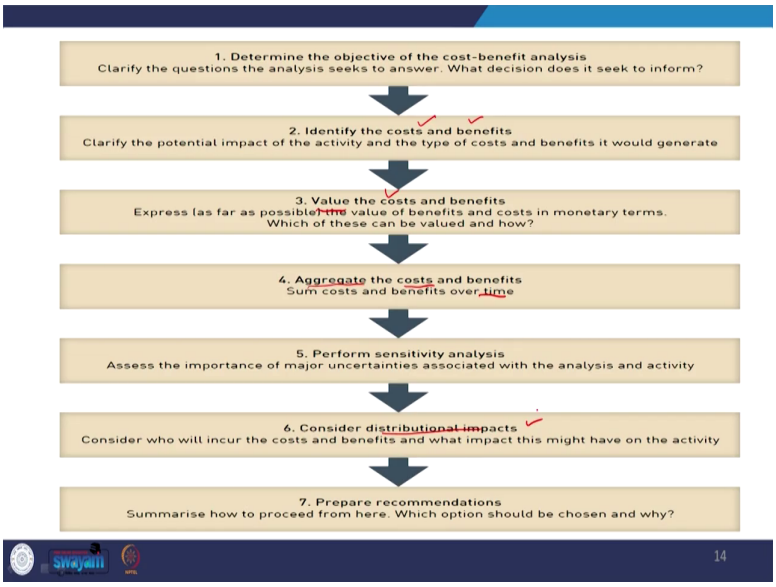


Based on this understanding now let us have a look the on the major steps that what are the key steps that we need to undertake for the implementation of benefit cost analysis.

So, first of all as you understand we need to determine the objectives of cost benefit analysis. What do we need to achieve? Whether it is the pollution control that is the air pollution or whether it is the controlling the traffic or what else? So, this here we need to actually determine the objective of the cost benefit analysis. So, here we need to clarify the questions. The analysis seeks to answer as well as what decision does it take to inform. So, that must be there.

And the second step is after understanding or after determining the objectives; we need to identify what are the likely cost and what are the likely benefits because of this particular projects or policy. And then after identifying these costs and benefits, we need to evaluate

these or quantify and put a price to these to all these costs and benefits. And after finding the cost and benefits and converting it in terms of monetary value that is the value is there, what we are doing? We are aggregating all the costs and all the benefits by taking into account the aggregation principle that we have already discussed.

And in case of some uncertainty and risk if you are finding that this variable is very seems to be very uncertain, so in order for deal these that which is very sensitive factor; if it changes then whole of the decisions will be changed. So, we need to find out that sensitive factors by doing this exercise of sensitive sensitivity analysis. So, ah in that way you can find out which is the most volatile factor that is impacting or that may impact our possible decision.

After doing this exercise, we need to see the distributional impacts that yes; this policy is to be implemented if it is to be implemented. Then, what will be the likely impacts, so far the across the socio economic ah sections of the society is concerned. So, this policy is for whom; whether for the for the richer section or poorer section or those who are actually needing it or those who are not needing it. So, that is what we need to consider the distributional impacts of this particular policy as well.

So, after doing this exercise the final step will be the preparing the recommendations in terms of report writing that yes, these are this pros and these are the cons. So, it is likely whether the benefits the overall benefits or the net benefits is greater than the costs or not, based on it the committee it can recommend that whether to implement or whether to go ahead with that particular policy or project.

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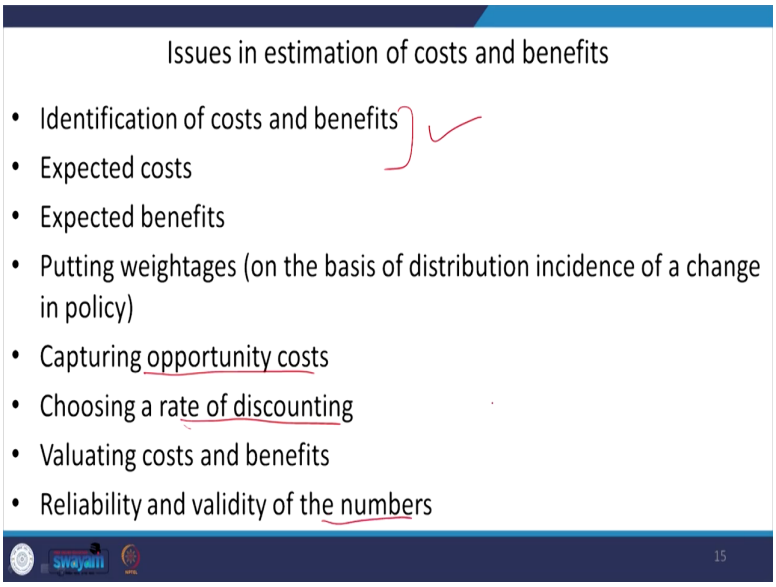


So, this is what in here we discussed about the cost and benefits, then and how we can practice it or apply it in practical situations. So, after understanding it, we need to understand what are the likely problems because it is applying this cost benefit analysis is not until easy up here. It is having certain problems or issues in estimation of costs and benefits. So, although we talked about the identification of cost and benefits are the crucial, but still it is very likely that we may omit certain costs, certain likely cost on or likely benefit out of a particular policy or project if you if it is to be implemented. So, that is again a tricky up here.

So, if a particular costs and benefits that will be will be observed, but at that point of time while calculating the committee or members or experts they could not identify that then obviously, it will be a problem in either leading to underestimation of this costs and benefits. So, that will be impacting this decision as well. And the second factor that is the expected costs. So that means, here we are saying that all the costs are to be converted into monetary

units and if the costs are spread across like over a period of time for 10 years let us say and you are sure about the present year or first year costs, but when you are saying these are for the for the implementation of a particular policy for the second year or third year this is the likely cost. So, it is expected, it is not the actual that is happening.

But again, for expected costs although we are taking into account these discounting factors, but still it is said debatable issue it is prone to uncertainty. So, likewise the same logic is also for the expected benefits, you do not know after 3 years what will happen, what after 10 years what will happen. And moreover, putting the weightages because we are saying in this so far the very premise of the cost benefit analysis is concerned we are giving more weightages to the less privileged income groups or less privileged sections of the society to whom the policies urgently necessary, but still there is a doubt or there is a controversy that whether we are we are able to identify those less privileged ah sections. And in that way if you are not doing this exercise then obviously, this distributional incidence of this particular policy and based on which we are putting the weightage, it will be it will not be a right exercise.

So, another ah issues that we are also encountering in converting this cost benefit into monetary units is capturing the right opportunity cost. So, what is the opportunity cost? As you understand that opportunity cost is the cost that we are foregoing the next best alternative that we are foregoing because of the same policy, or same project. So, if it is so, and if you are not calculating that there are n number of opportunity costs and there we are foregoing and their costs are not enumerated and quantify quantified, then there would be problem and it is a problem in finding this opportunity costs of a particular project.

Then again, this is also a debatable issue that how to find the appropriate rate of discounting. So, when you are saying that the particular benefits or costs, it will be spread about let us say 50 years and for the 20th year whatever the discounting rate you are take into account, send the discounting factor or discounting rate you are taking in to account for 50th year. So, choosing the appropriate discounting rate is really a very challengeable task and it is debatable issue.

And another ah problem that we are we may face in this CBA analysis is evaluating the cost and benefits. So, the same logic we can actually take into account that when the rate of discounting is not taken up or appropriate data or data discounting is not taken into account, depending upon the time dimensions then when you are just evaluating it that means, quantity into the price that is your value. So, when you will be evaluating then obviously, the cost and benefits will be misleading.

So, the last, but not least the problems that will be encountering in estimation of this cost and benefits is the question of reliability and availability of these numbers. So, let us say the cost is something like odd number 10000 dollar or 10000 rupees whatever and the benefit is this much as well. But however, we can rely these numbers because of all these we, all these issues that we discussed that if we have not appropriately identified the costs and the benefits then obviously, these values that we finally, get in terms of this net benefits so obviously, this is not a reliable figure. So, all this exercise that we will be doing you cannot say that it is a valuable one or at it will the CBA is a reliable tool. For a policymaker, they need to be very careful and calculative in doing this exercise.

So, after understanding is this the issues and challenges, let us understand the recent developments in the environmental cost benefit analysis.

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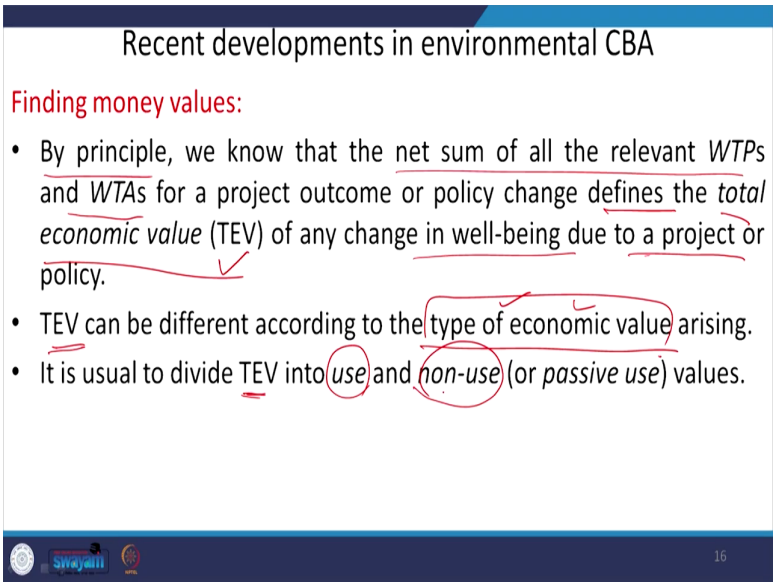


So, recently we are saying as you understand that this cost benefit analysis for by principles we are taken to account or the net sum of all the relevant willingness to pay and the willingness to accept for a particular policy or program, it defines the total economic value. So, this is by principle we have already discussed. So, this is nothing, but your total economic value of a set change that is a policy change or a program change or projects outcome, right.

So, this total economic value of this change it will be reflecting the change in the well being due to a project or due to the implementation of a particular environmental policy, right. So, this is theoretically by principle it is told. So that means, here when we are saying the total economic value is important and that is expressed in terms of willingness to pay and willingness to accept and we are measuring the change in the well being because of the implementation of a particular policy, then this total economic value can be of different dig amount. Why this and the amount of the total economic value will be different? Because it

depends upon the type of economic value that different consumers or different sections of the society those who are impacted by this particular policy they will be valuing this total this economic value.

So, when this section do have different economic value, then obviously the total economic value will be different. And again, in defining this total economic value this is divided into two broad parts two broad categories, one is your use value and the second one is non-use value, and this non-use value is sometimes known as the passive use values.

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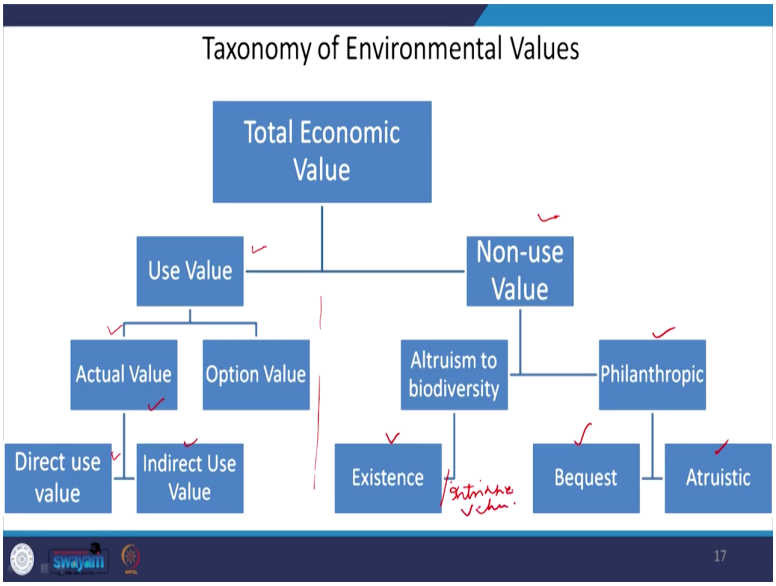


So, now let us understand ah the concept of total economic value. So, what is total economic value? Obviously, it is the summation of all the economic values, right. So, so it is categorized into use values and non-use values. And again, this use value is divided into two parts one is

actually use and the second one is the option use. We will be describing what is with example of what these values are.

And again this actual use value is of two types direct use value and indirect use value. And sometimes we are saying this actual use value can be conjunctive or non-conjunctive, it can it can also possible. So, this is the first categorization of use values and if you looked to this the second part, second segment of economic value that is the non-use value.

So here it is again divided into two parts altruism to the biodiversity that how you are having altruistic motive for preserving the biodiversity and how will be philanthropic for others that lead the biodiversity be preserved for others (Refer Time: 22:56) for others. So, you are showing your philanthropy, your selflessness although you are not using it or there is not likely that you will be using for in the future, but still you are saying the others will be using.

And in others your own future generations are also included, so that is the bequest and when you are saying altruistic it is for everyone even you do not know. And this ah when you are saying that this knowledge value is categorization to altruism, altruism to the biodiversity for the biodiversity itself, so this is known as the existence values. How about this existence value is different from the intrinsic value that we will discuss.

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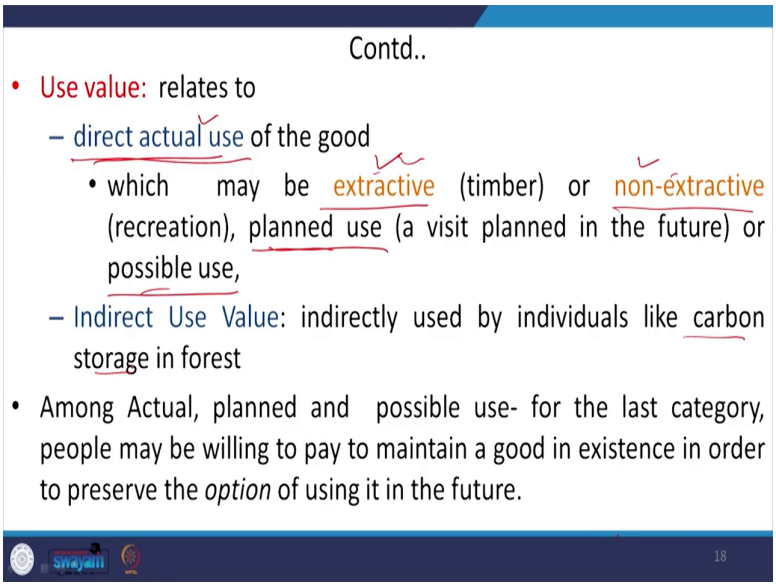


So, now let us understand what exactly are this taxonomy or categorization of values that makes that explains the total economic value. So, first one, we will be discussing use value and non-use value. These are the broad categorization. So, what is this use value? When you are directly using a particular environmental good; that is, use value. So, example you can say this let us talk about a forest system, right. So, from the forest you are extracting the timber, when you are extracting the timber the existence of the very timber is gone from the forests. So, that is why this is the direct actual use in terms of extraction or extracted actual direct actual use.

This direct actual use can also be non-extractive. Why? Because you will be obviously, directly using it or actually using it, but it you will not be extracting this portions or any portions of the existing resource from over there. So, let us talk about recreation. So, you are not extracting, although you are you are using it you are getting benefits, but you are not extracting any

material or energy from that resource. So, that is far and this is non-extractive. So, whatever the resource amount is there it is as it is.

And the second criteria is that this direct actual view actual use of the environmental good it can be planned that after 3 years although I am not right now using this particular good, but I will be I am planning for visiting or using the particular code after 2 years, 2 days or 5 days or 5 years. Or this third one is in case of possible use you are not planning, but still there is a possibility you may use this particular good in discussion.

So, whatever the case is that you can say these are the actual use value based on whether it is extractive or non-extractive whether it is planned or non-planned or whether it is possible. And the second category of this use value is indirect use value so that means, you are using it not directly you are not directly consuming it you are indirectly using it. So, in case for discussion that is forest you are not using forest as source, right, you are not extracting any timber or you are not enjoying it, but you know that this forest is serving as a carbon storage, right.

So, that is helpful, that will that that will be in indirectly helpful in tackling the climate change and you do not like this climate change or you are suffering because of this climate change problem. So, this is the categorization of use value.

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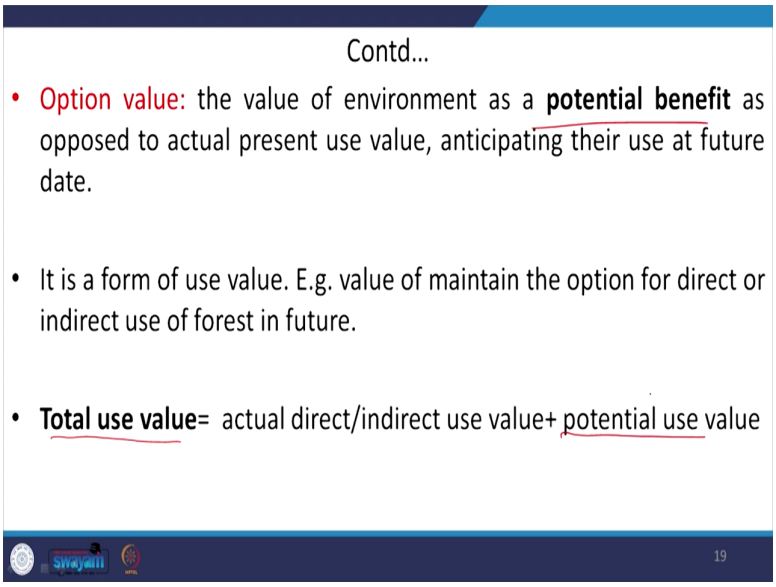


And the second categorization is of option value so that means, we are talking about the potential benefit itself that we will be getting. And we can say that any examples, you can take for the option for directly or indirectly using the forest resources in future. So, based on this understanding your total use value would be the summation of these values that is direct use value or indirect use value plus potential values. So, potential use value is a part of is also included in your use value.

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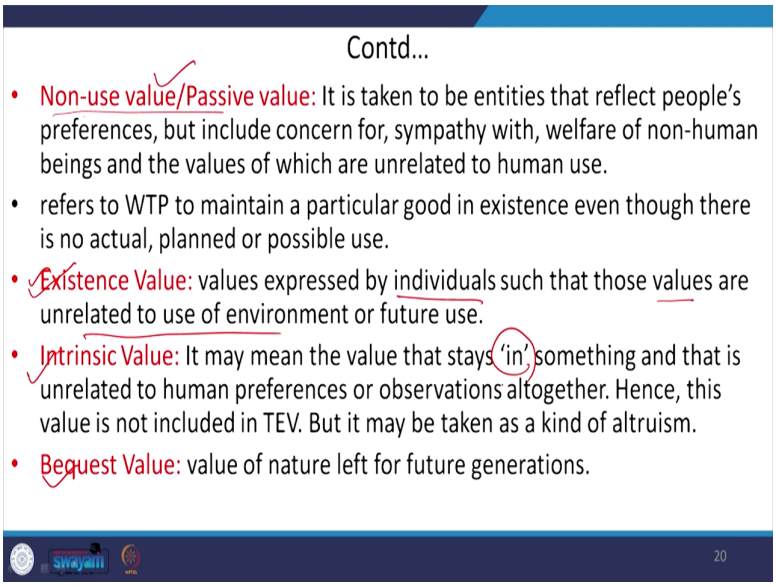


So, other categorization are non-use values that means, you are not neither you are using right now or even for the future, but you are actually thinking to keep a particular or your preference is there in order to have this ah that is on that is unrelated, right. So that means, here in non-use values we can talk about the existence values and request values. So, why existence values? Because you are expressing some preferences or capturing values that are unrelated to the use of the environment or the future use. Right now you are not using even for the future you are not using.

Obviously, this is a different from intrinsic because it talks about in something in the inside the particular system or particular animal or particular biodiversity. So, that is why this intrinsic system or intrinsic value is not included in the total economic value and because value is for the future generations that is also included.

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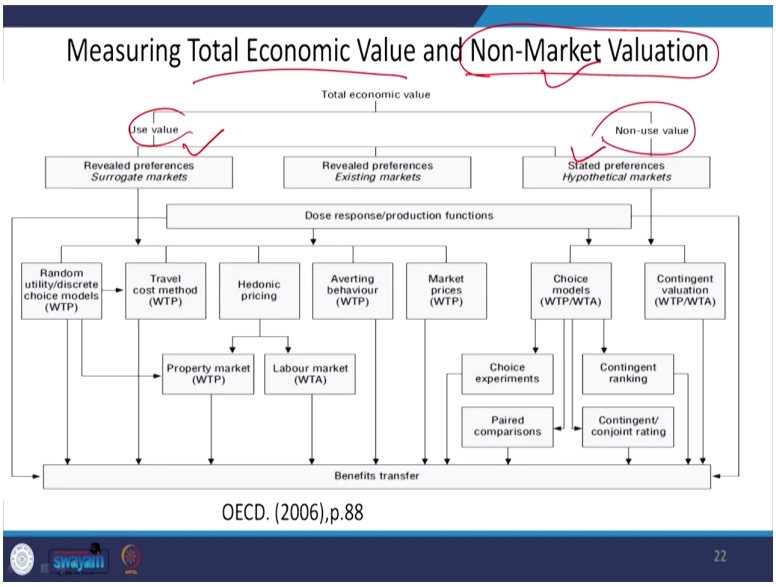


So, in a nutshell you can say that if you want to measure this total economic value. So, we need to go for these non-market valuations. So, again what is non-non market valuations, based on this use value and non-non use value we will be discussing in the next class by taking to account two preference method, one is the revealed preference method and the second one is stated preference method.

In the next class, we will be detailing what is the non-market evaluations and what are different methods to find the non-market evaluations in the environmental goods and services.

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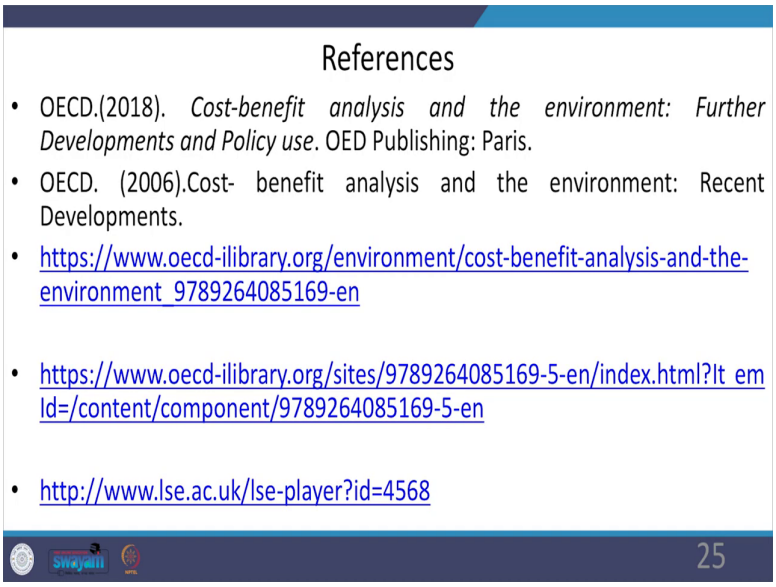


So, these are the references that you must go through in order to understand this cost benefit analysis.

Thank you very much.