Natural Resources Management (NRM)
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Lecture - 44
Environmental Impact Assessment (EIA) Part 4

Today, we will discuss following the previous method of EIA that we discussed that was fuzzy logic. If you may recall, that we discussed in detail about fuzzy logic in EIA and its different methodologies and assessment procedures, how we actually can assess through fuzzy logic. Today we will discuss another method, method number four, which is cost benefit analysis or we call it as CBA.

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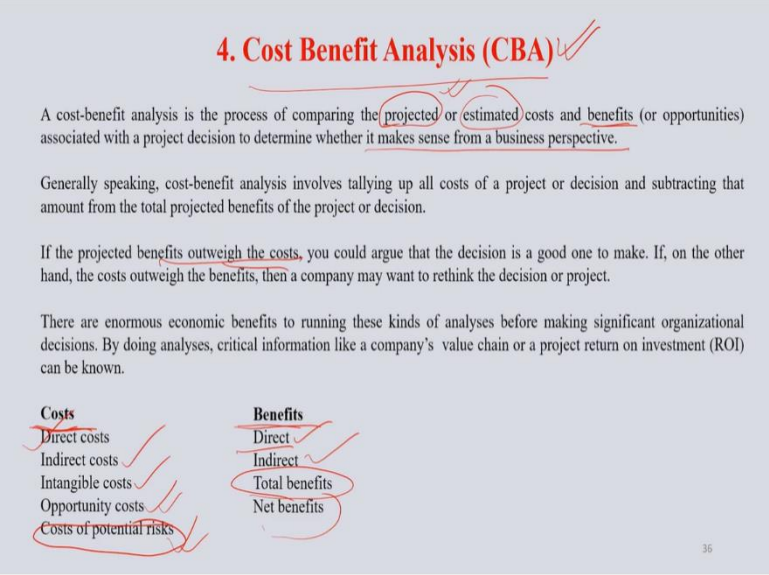

Now, cost benefit analysis of EIA is another very important method for successful EIA exercise. A cost benefit analysis is a process of comparing the projected or estimated cost and benefits. So, some costs which you actually, estimate or project that this much cost might be incurred for this particular project.

And then, the benefits out of that project or the opportunities out of that project that which are associated with a project decision. To determine whether carrying out this project makes a sense from a business perspective. Now, when we talk about this business perspective, they are also the environment has to be integrated.

We already, I think discussed quite a lot that any project we cannot say a successful one, only on the basis of business or monetary profit. The Environment Management restoration of environment is also another very key aspect under EIA and if that is not also taken care of then only having successfully having business perspective, you may not actually achieve the goal of your project.

So, in general cost benefit analysis involves, tallying up all the cost of a project or a decision that you have taken and then you subtract that amount from the total projected benefits of the project or a particular decision that you have made. So, the balance will definitely give you a clearer picture whether your project is a successful one or is a failure.

If the project benefits outweigh your costs, you could argue that the decision that you have taken is a good one to make. If on the other hand, the costs overlay the benefits, then a company may want to rethink the decision or the project that they have decided to implement. There are various economic concerns are also in any project are associated with huge amounts of economic benefits for running this kind of analysis even before you take a decision or implement a project.

As I said that in previous lecture, that the cost of taking a wrong decision or the cost of implementing a project without concerning the other impacts is much higher than investing some time or resources for carrying out a EIA exercise, because it works like an early warning for you.

You can correct the course by doing this kind of analysis which we have discussing over a couple of lectures, these are critical information, for your company value and also your company's investment, return, reputation all are in stake. So, a good EIA exercise is very important for all those things.

Now look at the just comparative table of costs and benefits associated with several kinds of projects that take place, especially in the field of development, utilizing various natural resources. Now direct costs, benefit is direct, indirect cost, indirect benefit, intangible cost, you have kind of a total benefits or net benefits if you have opportunity costs, costs to solve also potential risks are also associated.

Now, this cost of potential risk often we actually neglect. So, EIA actually helps you to get to know that what are the potential risks associated with a particular decision or a particular project that you are going to take. So, EIA, somehow will give a warning to you that see if

you take this decision or if you carry forward with this project, these are the different losses that you might have to face. So, a good cost benefit analysis under EIA helps you to understand the actual scenario of your project and decision that you made.

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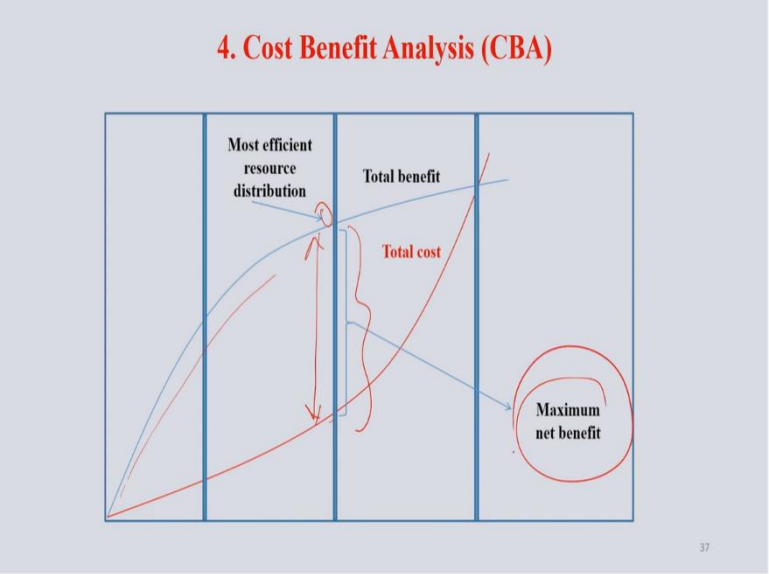

Now, this particular graph actually of cost benefit analysis, it tries to project that what is the point actually that you will end up with maximum net benefit. Because see, if you carry out a project investing crores of rupees, certainly there has to be, some benefits. Otherwise, how can you run a project? But at the same time, it is important to see that how this particular project in long term is impacting the environment and the society?

So, that is what is the work of EIA. Now, you see this blue line and there is a red line below. Now, the blue line is the line which shows the total benefit. And the red line is the total cost. So, the difference between these two basically gives you the maximum net benefit. So, the point where most efficient resource distribution takes place is here.

So, this is the point where actually you maximize the resource utilization because that is the point actually, you have your maximum benefit. Now at this point, if you also subtract the cost associated with that particular project, you basically get the maximum net benefit. Because that is what will tell you whether your project is now is going to be a sustainable one from our perspective or not.

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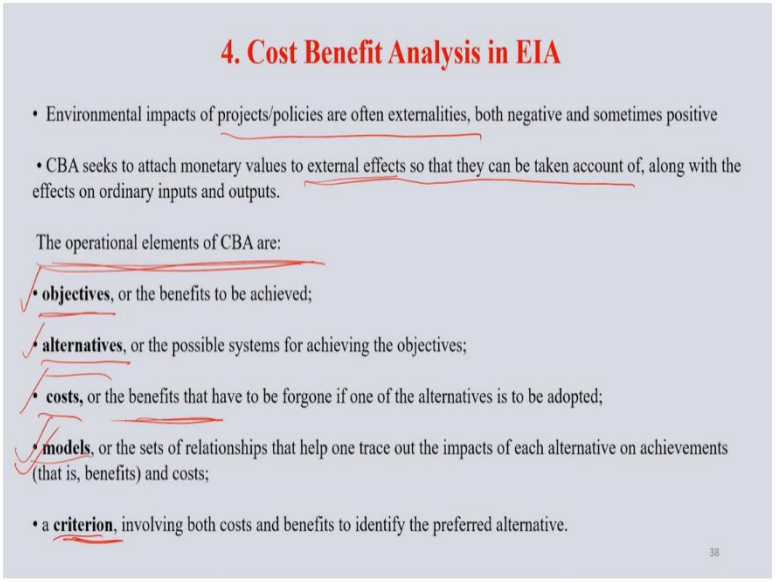

Cost benefit analysis, it also helps you to understand various environmental impacts of your project and policies and whether they have negative or sometimes also positive effects both the picture you will get through cost-benefit analysis. CBA also seeks to attach monetary values to the external effects. So, that they can be taken account of.

Now external effect could be climatic or weather events. It could be also associated with various policies of the government, decision of the local administration, delivery of local logistics, etcetera. So, these are the externalities which if you attach a monetary value with those then, you can actually calculate better that how much total benefit, actual total benefit that you are going to get.

The operational element of CBA are the followings, first, objective or what are the benefits that you want to achieve through a project or your decision for a project. Alternatives, or the possible systems for achieving the objectives. Costs or the benefits that have to be foregone in one of the alternatives is to be adopted. So here you actually get the decision that you take or the alternative that you choose, for that if you need to incur some costs that also will be understood through these analysis.

Models or sets of relationship that will help you to trace out the impacts of each alternative on your achievements or cost. So, any alternate that you choose how much is the cost and how much is the benefit that also cost benefits CBA will help you to understand. A criterion involved with costs and benefits for identifying the preferred alternative. So, CBA helps basically a company or a government to initiate or implement a project in a successful manner because it gives the clear picture of financial situation.

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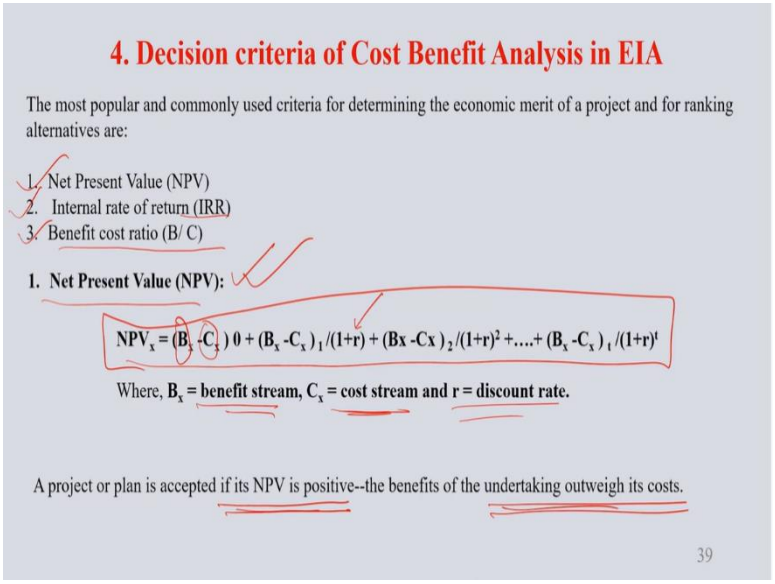

Now the decision criteria of cost benefit analysis in EIA. What are the criteria that you actually consider for CBA? The most popular and commonly use criteria for determining the financial aspect of a project or financial merit of the project and whether that particular project in long run is going to make profit or loss so that you will get to know. So, the criteria for determining those financial merit of your project is actually the most important part of your project success or failure.

Now, what are those criterion? Number one, NPV we call it net present value. Second, internal rate of return, IRR. Third, benefit-cost ratio. I think most of you have heard these terms, but these terms are also not only important in business, but also important in natural resource management. As you see that any resources that you are going to utilize for a project has to be considered from various aspect.

And of course, economics is one of the important aspects. Now NPV, how we actually calculate NPV?

This is the formula that we use for NPV calculation,

NPV is equal to the sum of the difference between Bx and Cx values at time 0 to t, divided by the sum of 1 and r to the power t, where r is the discount rate

where Bx is equal to benefit stream, Cx is equal to cost stream and r is equal to discount rate.

So, this helps you to get the net present value.

Now, the project is accepted, if its NPV value is positive. This is very important to remember. The benefits of the undertaking of a project has to outweigh its cost. There is no compromise in that. Otherwise, that project is a failure, it is not sustainable, or is not even ready to take off. So NPV has to be positive.

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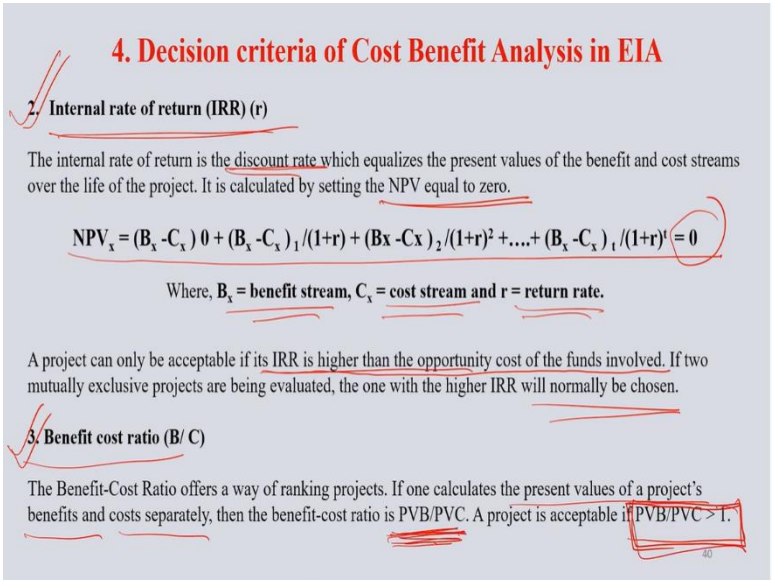

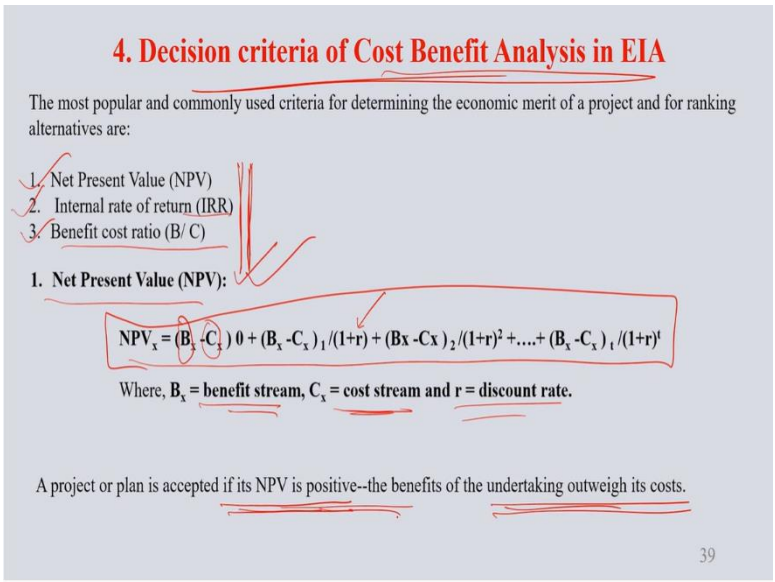

Second, the internal rate of return, IRR. Now internal rate of return is the discount rate which equalizes the present values of the benefit and cost streams, over the life of the project, and it is calculated by setting the NPV value to 0, remember that. How do we calculate that? Here, this is the formula.

NPV is equal to the sum of the difference between Bx and Cx values at time 0 to t, divided by the sum of 1 and r to the power t, where r is the discount rate

So, as you see that here we are setting it as 0, NPV value. So internal rate of return if you want to know, then you have to set NPV to 0 where again Bx is equal to benefit stream, Cx is equal to cost stream and r is equal toyour return rate. Now, a project can only be acceptable if

its IRR, internal rate of return is higher than the opportunity cost of the funds involved or investment involved. Very clear.

If your IRR is higher than the opportunity cost or the investment that you have made, then that project is acceptable. If two mutually exclusive projects are being suppose evaluated, the one with the higher IRR will normally be chosen, the other one will be rejected. Even if suppose that is important for the people, that is important for the environment, whatever it is, but if it does not match with IRR expectation that will be rejected.

Next benefit-cost ratio. Now benefit-cost ratio offers a way of ranking your projects. If one calculates the present values of a project's benefits and cost separately, then the benefit-cost ratio is its PVB by PVC. So, PVB by PVC, this is the ratio will be your benefit cost ratio, a project is acceptable when PVB by PVC project value benefits: project value cost ratio is greater than 1, clear.

So, I just repeat that these are the three most important criteria used for cost benefit analysis and if NPV is positive, then you allow a project to go ahead, if IRR is higher than the cost involved, then you allow the project, otherwise you reject. If your benefit is to cost ratio is greater than 1, then you accept or allow a project to go otherwise you reject. Very clear cut.

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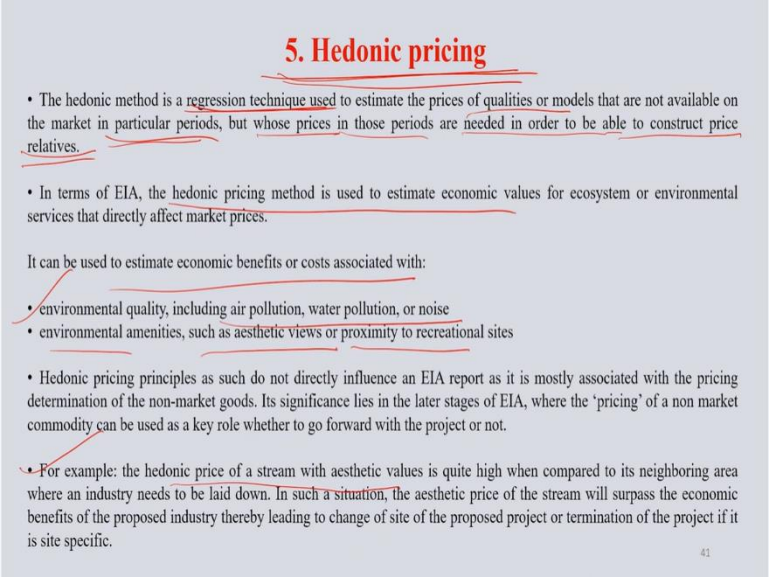

Now, next we go to the fifth method of EIA. So, this was our fourth method or CBA. Now we will talk about the fifth method of EIA, that is hedonic pricing. What is hedonic pricing? Hedonic method is a regression technique, which is used to estimate the prices of qualities or

models that are not available in the market, in particular period, but whose prices, prices of those models in those periods are needed in order to be able to construct the price relatives.

So, you understand, hedonic pricing process is a method which is a regression technique normally used to estimate the prices of qualities or model that are not available in the market, in a particular period. Say certain things which is available in winter but not available in summer. But when you start the project you also need to calculate, estimate. So, what do you do that, even though those things are not available in that particular period, but their prices in those periods are still needed in order to be able to construct the price relative.

Now, how do you do that? That is what hedonic pricing helps you. If you look at in terms of environmental impact assessment, the hedonic prices method actually used to estimate the economic values for ecosystem or environmental services, that directly affect the market prices. Say for example, if your weather is good, conducive, suppose say rice, we know that rice requires huge amount of water, that means good rainfall.

Now, if in some year there is not good rainfall and also suppose irrigation is not available due to some region so, that rain which is environment parameter can directly affect the supply or the delivery of the availability of the rice in the market. And that is how the price of the rice will also be decided. Because if your rain is not good, the yield will go down. If rice will go down the supply of rice in the market will go down. And we know from basic economics, if supply goes down, price will go up. So that is how you know even ecosystem or environmental different services can directly affect your market prices.

Now hedonic pricing can be used also to estimate economic benefits or costs associated with environmental quality, including air pollution, water pollution, or noise, environmental amenities such as aesthetic views, or proximity to recreational sites, hedonic pricing principle as such, they do not directly influence the EIA report. Why? Because it is mostly associated with the pricing determination of the non-market goods like potato, onion, these are market goods, but a beautiful pasture, a good rainfall, a nice meadow or nice jungle path or track or whatever. So, they are not rightly market available goods, they are rather non-market goods.

Now, hedonic prices help to evaluate those value of those non-marketable goods in EIA exercise. Its significance lies at the later stage of EIA, where the pricing of non-market commodity can be used as a key factor, whether you go ahead with the project for you stop it. I explain it. Suppose the previous all the methodology that we have followed including cost

benefit ratio and etcetera, fuzzy logic etcetera, we were looking at the feasibility of the project from technical point of view, for economic point of view.

Now here, hedonic pricings are also looking at certain other aspects, like ecosystem services, the beauty of nature, the air quality. So, these aspects are not available in the market. They are non-marketable product, but they have a value. Now hedonic price, that is what it said that at far end of EIA, when all, everything is right, good, tick mark, then the final call, whether the project will go ahead or will be stopped, depends largely on hedonic pricing, because this is one aspect will be looked at as the fagin after checking all those other aspects.

And here also if you fail, in certain parameters, the project will be stopped. For example, the hedonic price of a stream with aesthetic values is quite high. When you compare to its, neighboring area where there is an industry need to be established. In this kind of situation, the aesthetic price of the stream probably will suppress the economic benefits of the proposed industry. You understand?

Suppose, Arunachal Pradesh, Tawang, those areas if you visit there, fantastic natural beauty. Serene, you feel good internally, your mind get freshen, those have enormous ecosystem services that they are providing those kinds of natural condition. Now, if you bring in an industry, there in one village and the other village suppose has one of the most beautiful natural stream where people go there, spend time, six hours, seven hours, people are traveling by vehicle to go and see that particular falls or stream.

Now if you have industry come and now if you evaluate and you go with the exercise of hedonic pricing, then you will find that the price of having, the aesthetic price of having that stream next to that proposed industry in the nearby village, will be much higher than the industry. The industry after producing several products, those things, if we economically calculate may not come near to the value of that having that stream without that industry.

So that is the kind of pricing that this process actually help. So, in that kind of condition, you need to actually terminate the project, if you see that there is a significant difference of values between that particular stream and this industry. So that you have to take a very wise call, whether to continue with the project or to stall it.

And you know that in many places across India, we have this kind of debate for many, many projects, which are proposed. Proposing is easy, but implementing is challenging, because then ideally you should go through this kind of process that I have been explaining to you.

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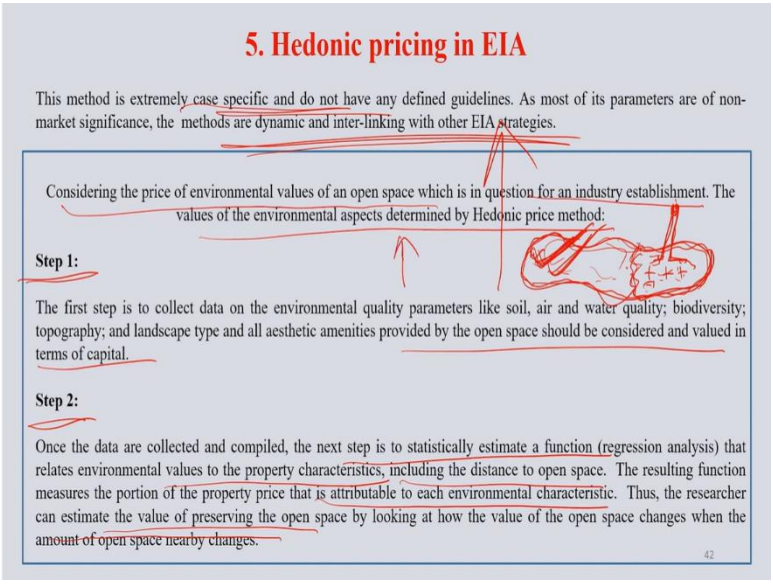

As I said, hedonic pricing method is extremely case specific and do not have any kind of defined guidelines, as most of the cases the parameters that are considered for hedonic pricing, exercise are non-market products, non-market variable. So, the methods are dynamic and also interlinking with other EIA strategies.

Now, if you consider the price of environmental values of an open space, which is suppose is proposed to have for an industry to be established in that particular empty space, the values of the environmental aspects will be then determined by hedonic pricing method. A beautiful open space, lush green with grass, nothing is there but when people go there, they feel very happy. They get reenergized.

So, if in that open space you propose or somebody decides to have an industry there in open space, then how you actually going to evaluate, whether to have it or not, hedonic prices actually will help you. How? Step one, the first step is to collect the data on the environmental quality parameters of that open area like soil, water, air, biodiversity, topography, landscape, and various other aesthetic amenities provided by that open space should be considered and valued in terms of capital. That is the first step.

Step two, once you have collected and compiled the data, the next step is to statistically estimate a function that relates environmental values to the property characteristics, including the distance to open space. And the resulting function will measure the portion of the property price that is attributable to each environmental characteristics, very clear.

And thus, you, me as a researcher, we can estimate the value of preserving that open space by looking at how the value of that open space changes when the amount of open space nearby also changes. Because, suppose this is your open space and an industry is proposed suppose here, in this particularly, in this this area. Now you need to see that having this open space here and the industry next to that particular open space, how it is going to affect environmentally, how much actually the price that you pay for having this from the quality of life. So, that is what, that we need to estimate the value of preserving that open space.

So, if your some part of your open space is occupied by some other activities or project, hedonic pricing also allow you to understand that with any change in the part of this entire opening space, like in this space, how actually the value of the remaining space will also change.

You will find in most of the cases if some part of the open space taken and you make a small project there, you will find that the price of this or remaining open space might go even much higher, because people will feel to go there more and there will be less space, but number of people will be much higher because some space has been taken off. So, this is how hedonic pricing actually help you to calculate the impact.

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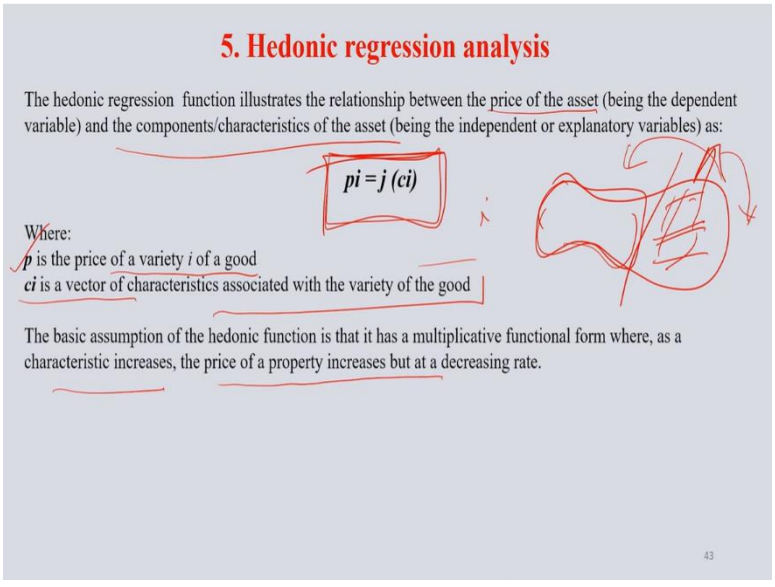

Now the hedonic regression analysis or the function. It illustrates the relationship between price of the asset and the components or characteristics of the asset. This is the formula or expression through which we can actually calculate it or estimate it.

The price p of item i is equal to j times the characteristics vector ci ,

where p is the price of a variety i of a good. ci is a vector of a characteristic associated with the variety of the good, that is j.

The basic assumption in this function is that it has a multiplicative functional form where, as a characteristic increases the price of a property increases, but at a decreasing rate. As I said that, if in a part of your beautiful open area, if tomorrow, if some project is coming there, then the remaining part, the pressure, the demand of remaining part for open space will be much higher. But with time, you will see that if that project continues there, then slowly, slowly there is a chance that the surrounding environment might get impacted.

And so, the price of the property surrounding that area will still go high, go higher, because the demand is higher, because the space was like this and taken this much space off. So as the supply is less, demand is high, price will go but as there is a project is coming this will have also affect on the surrounding area, even if suppose at the beginning it is not having any impact but in long run it can, people will become little bit conscious about that. They will think twice before getting that particular property or to buy something there.

So, the price of that particular land even though will increase, keep increasing but is it decreasing rate, the way before this suppose project came into it will not increase in that rate. So, these kind of hidden qualitative factors or qualitative information can also be utilized for economic or financial estimation or value estimation through hedonic analysis. So that is why it is important as a part of EIA exercise.