Environmental and Resource Economics
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Daly's Operational Principle of Sustainable Development and Impact of Environmental Regulation on Firm's Competitiveness Part - 1

So, welcome once again to our discussion on Sustainable Development. Yesterday we are talking about sustainability rules basically weak version of sustainable development rule and then strong version of sustainability rule. And we said that in weaker version of the sustainable development definition basically we need to ensure only the total capital stock that means, manmade physical and human capital should be constant.

And why is it called weak? Because it allows substitution possibility between manmade capital and natural capital, but in strong version of sustainable development, they believe that substitution possibility between manmade and natural capital is actually not possible and even if it is possible, it is not a perfect one as it was assumed in weaker version. So, that is why its stronger version strong sustainability rule, it requires that total stock of natural capital should be constrained.

And another version is even more stringent, we did stronger version of sustainable development which says that critical natural capital particularly the atmospheric composition, ozone layer, these type of critical component within the natural capital group should be make constant, because these critical capitals are required for our very survival. Now, once we discuss about weak sustainability and strong sustainability, those concepts, those ideas are basically discussed at the theoretical level.

Now, the next question that economists they ask themselves about how to operationalize these sustainability rules. So, we need something we need some rules which we can actually operationalize in empirical world to ensure sustainable development, given that need in background economist Herman Daly, he published a paper in the journal ecological economics, where he basically prescribed certain principles to ensure sustainable development, which was, which got popularized as Daily's operational principle for sustainable development.

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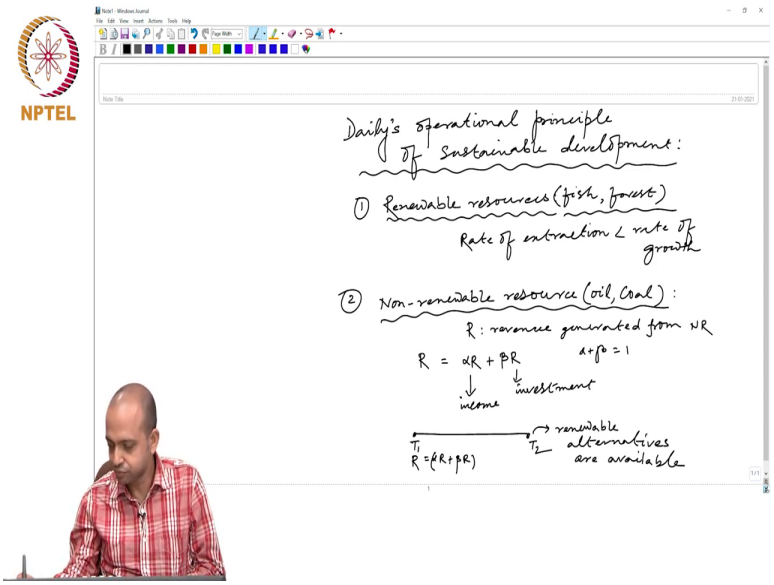

So, this is what we are going to discuss today Daily's operational principle of sustainable development. So, Daily's idea of ensuring sustainable development was quite logical, it was logically derived and easy to understand, what Herman Daly he said that to get these principles for ensuring sustainable development, we must think what are the channels what are the different channels through which we are actually disturbing the environment or indirectly we can say that what are the channels by which we are affecting the nature or natural environment.

Now, if we pose that question, then these are the three ways by which we are disturbing the environment by extracting renewable resources, so for renewable resources, what Daly said that the rate of extraction should be lower then the growth rate of the renewable resource.

This renewable resource for example, fish or forest for example, so what he said that rate of extraction should be less than a rate of growth, if growth rate is higher than rate of extraction then that will always preserve a critical amount of stock of this renewable resource, which should be adequate for this renewable resource to have their regenerating capacity, that is why rate of extraction should be lower than rate of growth that is the first principle when we think about maintaining sustainability of this renewable resources, non-declining renewable resource stock.

Second one is non-renewable resource, these are oil, coal, so on and so forth. And the idea to maintain sustainability for non-renewable resource is quite it is little involved, what Herman

Daly he said let us say that by extracting non-renewable resource we generate R amount of revenue, R is the revenue, let us say generated from non-renewable resource which in short I will write NR.

Now, this total revenue should be decomposed into two components, one is called income component and another one is called investment component, let us say that R equals to alpha into R sorry, alpha into R plus beta into R, so that means alpha fraction of the total revenue this is let us say called income stream and this is called investment scheme, where alpha plus beta equals to 1.

So, alpha fraction of the revenue that we generate from the extraction of non-renewable resource that is called income and beta fraction of this total revenue which is denoted as investment, if that is the case, then what Herman Daly says that the economy can enjoy only the income component of the revenue derived from the extraction of non-renewable resource.

And this investment component should be reinvested into renewable alternative, so that when the stock of non-renewable resource comes to an end for economic extraction, then we get a renewable alternatives which will give you equivalent amount of service what you wish to derive from the non-renewable one at the starting of the period.

So, that means basically they say that, let us say that this is the starting point of extraction, let us say this is T1 and you generate the revenue R where it is equals to alpha R plus beta into R, so alpha R you enjoy as income beta R is reinvested so that at the end T2 when your stock of non-renewable resource comes to an end for economic extraction, then we get an alternative of renewable resource or I would say that non-renewable, here I will say that renewable alternative are available, this is his idea.

Now, the question is, how do you derive this, how do you decide about this beta, that means what is the component, what is the fraction we should keep for investment that we should decide, what are the factors. So, what are the factors?

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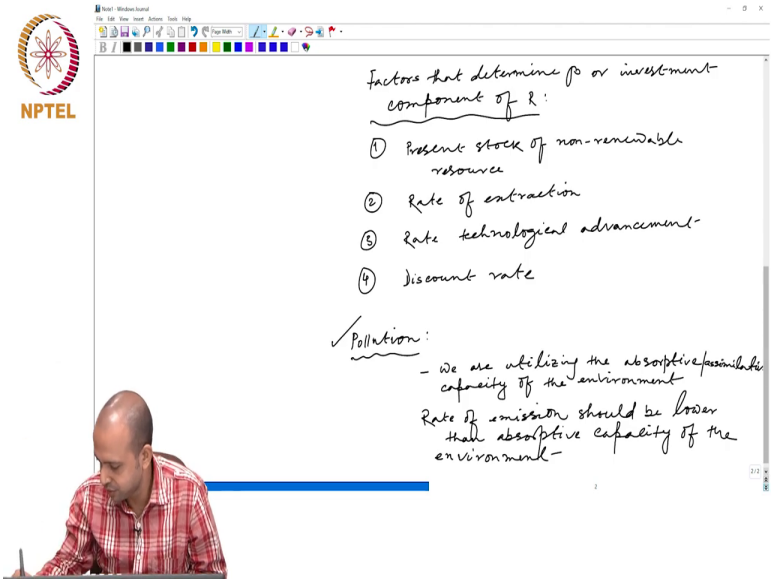

Factors that determine beta or the investment component of R. There are certain factors, firstly the present stock of non-renewable resource that will determine then what is your rate of extraction, thirdly, rate of technological advancement, then fourthly, what is your discount rate, these are the main factor.

So, that means if the present stock of non-renewable resource is too much, so obviously you can invest very less amount to get alternatives, if the rate of extraction is too high, then the stock will get depleted very soon, so obviously you should spend more for investment, larger fraction should be kept for investment.

If the rate of technological advancement is quite high that means, you expect that immediately we are going to get an additional an alternative technology which will make it possible for the renewable alternatives to have. And discount rate, if you discount rate for the future that means we must understand the renewable alternatives would be available after some point of time.

And what would be the benefit? That means, if we feel that the present benefit of the non-renewable resources are too much, then we should actually keep beta at a very lower level. But if we feel no, the present value is not that much rather actually the future value of this is quite high then the beta should be the fraction should be higher.

So, these are the factors that will determine what should be the beta fraction of non-renewable revenue that we must keep for investment. So, this is about the rules related to the non-renewable resource extraction.

Then, the last one related to pollution. This is the third channel by which we are actually disturbing the environment. And when we make, we are making pollution actually, what we are doing? We are utilizing the absorptive capacity of the environment.

So, that means, we must decide first about what is the nature's absorptive capacity and while making pollution that means rate of emission should be, what is the rule then? Rate of emission should be lower than absorptive capacity of the environment .

So, at any point of time our rate of discharge of emission, rate of discharge of pollutants should be lower than the nature's absorptive capacity. If that we can ensure, then we can maintain sustainable development. So, these are the three principles basically, principle number three is related to pollution, principle number two is related to the extraction of non-renewable resource and principle number one is the rule is the principle related to the extraction of renewable resource and if these three principles we can assure, if we can assure that these three principles are satisfied, then according to Herman Daly operational principle will say that we are on the sustainable development path, this is how we can ensure.

Now, once we get to know about this operational principle of Herman Daly, the next question that comes to our mind is, now we have decided about the operational principle, now we need certain indicators, we need certain indicators to measure sustainable development and these indicators will also help us know about which country has achieved sustainable development to what extent. So, our next topic for discussion would be indicators of sustainable development.