Conservation Economics
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Module 8
Public sector and Conservation
Lecture 1
Externalities

Namaste! Today, we begin a new module which is Public Sector and Conservation. This module will have 3 lectures - Externalities, public goods and common resources, and the design of the tax system. This lecture is about externalities. But before we begin, let us have a look at this principle of economics that we are touching in this lecture. Markets are usually a good way to organize economic activity.

Why are markets good ways to organize economic activity? Well, there are several reasons. Things like, there is an option of a free will, the buyers and the sellers see for themselves what is in their best interest, and they act according to their own best interest.

There is an option of free will; there is an option of choice because the market is going to provide those goods and services or those variety of goods and services that are going to increase the welfare of the buyers and the sellers.

At the same time there is a quick transfer of information, there are prices that act in the market that provide information about the demand and supply in the market. So, if the price of something is high, it means that that particular good probably is in high demand, and that would give a signal to the sellers to manufacture more and more of that good, so that they can also have a share of the profits.

And at the same time all of these also increase the efficiency of the system. So, it increases the benefits of the majority of people in the society which is why we say that markets are a good way to organize economic activity. But the thing is they are not always. It says here markets are usually a good way, but not always. Why?

Because when the markets are working by themselves, we have observed or we have suffered from a number of environmental and ecological damages things such as the Minamata disaster of Japan. Now, we will look at this in greater detail in the 12th module, but in short the Minamata disaster occurred because there was a company producing acetaldehyde that was dumping the used catalyst into the oceans.

So, whenever there is a production process, there will be some kinds of waste that are generated. Now, in this case in the case of the Chisso factory that was manufacturing acetaldehyde the waste was they spent catalyst that was having mercury inside. Now, the company could have done two things. One, it could have treated the waste before it was disposed of which was the

right option, but it would have incorporated a certain cost to the company.
The cost of trading the cost of installing equipment in the company to treat the waste. That was the right approach, or the approach that we as a society would have preferred. But for the company it was something that was in it that would have led to an increase in the price or an increase in the cost of production.
What they did was, they did not treat any of the suspended catalyst and it was directly dumped into the seas. Now, when you add mercury into a system, mercury is a heavy metal and causes a number of neurological disorders. The nerves of the body do not function that well when somebody is fed with mercury.
In this case what happened was when the suspended mercury or the compounds of mercury when they were dumped into the seas, it started entering into the bodies of several organisms. And in a short while people started to observe that the fish in the seas were dying and they were coming on top. They were floating on top and Minamata happened to be a very good fishing village, fishing was the major occupation in this village.
And in a fishing village when you observe that so many fishes are dying off, it creates a problem of livelihood because if there are no fishes what will the fishermen do. Second thing that they started to observe was that the cats in the city started to show very bizarre symptoms. They started to show repeated movements, they started to commit suicides because of the neurological disorders.
After a few more years, people started to document that we were seeing all these symptoms in humans as well because the humans who were eating the fish from this sea that was contaminated with mercury were also getting mercury in their own bodies by means of this food - the fish. And so people also started showing a number of neurological disorders.
When the cost was computed of the extent of environmental damage, the extent of health damage, and the extent of social damage, it ran into a compensation of billions of years of billions of yens per year. So, that is the Minamata disaster of the 1950s. Now, in this case, the company could have treated the waste before it was being dumped.
In that way, this disaster could have been prevented. But then because the company was acting only in self-interest, it was not looking at the interest of the society, so it ended up committing such a big blunder that it ended up paying a huge amount of money out of the company's coffers as well. Now, this could have been prevented had this externality been internalized in some manner.
Another example is the London smog of 1952 in which so much pollutants were released that it created a big social menace. The release of dioxins from the Seveso plant in Italy in 1976. The Love Canal waste dump, now this is a very important waste dump story because in this case what was done was that these waste the industrial waste extremely toxic chemicals, they were just dumped into an area with no treatment at all.
After a while this dump yard was covered with a small bit of soil, and then it was sold off to be constructed into a school. So, a school was actually constructed on top of a dump yard that was having extremely toxic industrial chemicals.
When the pupils in the school started showing symptoms when the pupils started getting ill, then

people came to know about this. Now, in this case as well there was a company that was dumping these waste to cut its costs, it is just a cost cutting approach nothing else.
If we have a look at the Bhopal gas tragedy in our country in 1984, in this case as well it was just a simple matter of cost cutting. What the company did in those days, the Union Carbide Corporation, what it did was that to cut costs it started accumulating the MIC liquid that was extremely toxic and should not have been accumulated in large quantities.
And then when it was accumulated, it was kept in those tanks that were not that well maintained. So, into those tanks water was able to seep in. The liquid had to be kept refrigerated because it was extremely reactive when the temperatures went up, but the refrigeration unit was shut down to cut costs.
Also when the gas got released because of this poor maintenance, the flare towers were not working, the chemical wash towers were not working. So, all of these things could have been prevented had the company actually spent some amount of money into proper maintenance.
Now, that was expected of them because as a society we do not want to have companies that release such toxic chemicals into the environment.
But a company that was only working on a profit motive, it did not consider these social costs that get involved. Again here is when there was an externality in pain. Or the Chernobyl nuclear accident or deforestation pollution global warming you name an environmental problem, and there are a number of externalities that are involved in most of them.
So, while markets are usually a good way to organize economic activity, they are not always because of a number of market failures. Now, what is the market failure? The markets have a big role to play in our society because they increase the welfare of the people, they increase the welfare of the buyers, they increase the welfare of the sellers. And theoretically they should bring the society to a level that is the optimum level.
So, you cannot increase the welfare of any particular person without reducing the welfare of someone else. hm In those situations, they say that it is an optimal level of welfare.
Markets, if they work well, should be able to bring the welfare to the optimum level because each seller will be able to get the highest profit for what he is making, and each buyer will be able to get all the products at the cheapest possible cost and at the best quality. Now, this is what the market is telling us. But a market failure occurs when through some processes this optimality or this level of welfare is not reached.
So, market failure is a situation in which a market left on its own fails to allocate resources efficiently, that is it fails to allocate the resources things like money, things like time, things like resources to those units or those companies that are acting in the best welfare of the society, so that is a market failure.
And two major causes of market failure are externality and market power. Externality is the impact of one person's actions on the well-being of a bystander. So, in the case of externality, what we are saying is that there is an actor who is doing something, and because he is doing that there is an impact on a bystander who has got nothing to do with that action.
For instance, the students who were studying in the school that was built on the Love Canal site, they had got nothing to do with the dumping of these toxic industrial waste into the Love Canal,

but still they had to suffer the consequences. So, that is an externality because the action was done by one company to put untreated toxic industrial waste into a Canal site, and to sell that off to for the construction of a school.

But the impacts were suffered by the students - small children who had got nothing to do with that. So, the small children in this case, the pupils were the bystanders. And the company who was dumping these chemicals was the actor in the case of Minamata disease as well.

The company Chisso Corporation was the actor who did the action of dumping untreated mercury laden industrial waste in the form of spent catalyst into the seas. The fishermen did not ask the company to dump that.

The fishermen were completely bystanders, the fishes were completely bystanders, the cats in the city were bystanders, the residents of the city or of nearby places were all bystanders. They did not ask the company to do that.

But the company made this mistake of dumping the chemicals, but the consequences were suffered by all of these. Or the Bhopal gas tragedy, in that case the people of Bhopal did not ask the Union Carbide Corporation to maintain its plants in a sub optimal level to store a large quantity of the MIC gas and to shut down all the safety precautions, the people of Bhopal did not do that.

They had got nothing to do with the action of the company which was to cut down the cost. And to blatantly flaunt all the good practices that are required in the storage of this chemical MIC. But then this suffered when this chemical got released. So, the people of Bhopal in this case were the bystanders.

All of these are examples of externalities and the impact of one person's actions on the well-being of a bystander. Another cause of market failure is market power. The ability of a single economic actor or a small group of actors to have a substantial influence on market prices. A good example is a person in a village that is suffering from drought conditions and this is the only person with a well.

So, you can charge any amount of money. Or another example is say a contractor that is purchasing sugarcane from a very large area, and he is the single contractor. Now, in that case whatever price he offers is the price that the farmers of sugarcane will get. So, he has a tremendous amount of market power.

We can have market power in terms of the seller, for example, the owner of the well in the drought village or in the form of the buyer when you have only a single buyer such as the contractor of sugarcane from a very large number of villages.

If you have buyers or sellers who are in a very small number, in those circumstances it is very much possible that one or a few buyers or sellers may influence the market prices, and that is known as market power. So, they are having power over the market in terms of the price that the market brings up.

Now, in this lecture, we will focus on externality, the uncompensated impact or the impact of one person's actions on the well-being of a bystander. And when we talk about externalities, we can have negative externalities or positive externalities.

Negative externality is when the bystander is impacted in a negative manner such as if there is a company that is releasing pollutants, the people in the surrounding area have to suffer the health

consequences and so it is a negative externality.
And so in certain other cases we have a positive externality such as things like vaccination. So, if people get vaccinated, they are not only protecting themselves, but they are also providing herd immunity for the community which means that the diseases will not be able to spread that easily in a community where a large number of people are already vaccinated.
So, they are providing a positive impact through their vaccination, through their action of vaccination, they are providing a positive impact to the bystanders in the community who did not ask these people to get vaccinated, who did not pay money for them to get vaccinated, but they also receive a benefit because their community and from that they themselves are now less prone to getting the disease. That is the positive externality.
We can also talk about production externality and consumption externality. The production externality is something that occurs when there is a production of a good. Consumption externality is something that occurs when there is a consumption of a good. When the company is producing something and is releasing pollutants this is a production externality.
If somebody is buying those products, then through this process of buying or through the process of using certain products if they are releasing pollutants, then it is known as a consumption externality. A very good example is those vehicles that release a large amount of smoke.
The people who are consuming these vehicles, who are using these vehicles, are spreading pollution into their communities by means of consuming this pollution spreading vehicle.
In this case, they will say that it is a consumption externality. So, let us now look at these four combinations. So, we have negative or positive, and we have production and consumption.
So, we can have negative with production, negative production externality. Negative consumption externality, positive production externality, and positive consumption externality. And we look at all four of these.
Let us begin with the negative production externality. There is a production that is going on and it is leading to a negative externality or negative consequences. When a firm's production reduces the well-being of others who are not compensated by the firm. When a firm's production, there is a production that is going on and this production reduces the well-being, which is negative of others who are not compensated by the firm.
Good examples are industrial pollution and loss of ecosystem services due to mining. Now, in the case of mining, there is a company that is doing a production of these minerals or coarse. And because of this activity there is a loss of ecosystem services in the form of say clean air or clean water in this area. So, this is a negative production externality.
Industrial pollution also is another negative production externality because the industry by means of producing something the producing goods it is creating pollution in the surroundings that is reducing the well-being of others who are not compensated by this particular industry.
In the case of negative production externality, we can differentiate between the private marginal cost and the social marginal cost. What is that? Private marginal cost is the direct cost to the producers of producing an additional unit of a good. It means that suppose there is an industry that is manufacturing pens. And in the manufacture of pens, they are using a process that releases a large amount of smoke to take a hypothetical example.

The cost that it takes the company directly to manufacture one additional unit of a pen is the private marginal cost. So, it is a private cost. So, this is a cost that is being paid by the company. So, it is a direct cost to the producers. And at the same time, this is a marginal cost which means that it is the cost of producing an additional unit of a good, just one more pen. How much does it cost the industry to manufacture just one more piece of pen?

Now, this is marginal, because we are not talking about an average cost, we are not talking about the cost of manufacturing a hundred pens, we are just asking the question what is the cost of one more unit of production. And direct cost because it is the cost that will be paid by the company.

Another cost that is involved is the social marginal cost. When society uses this good, now when the producer is making it, it is the producer who is making it for somebody. So, somebody is going to purchase this good.

Now, the buyers who are going to purchase these goods will pay the company a certain amount of money which is the price of this particular product, but they are not just paying the company, but they are also paying the doctor or the healthcare system.

Why? The pollution that was created by the production of one extra pen is also causing a negative side effect on a number of people in their community who will have to pay for their own health costs because the company is not compensating them for the pollution.

Now, if we add that cost to the price that is actually paid for the purchase of one pen that is the social marginal cost. So, it is the private marginal cost to the producers plus any cost associated with the production of the goods that are imposed on the others, so that is the social marginal cost: the cost to the society of one extra unit of something. Now, that cost is paid to the company, and it is also paid to overcome the side effects of production.

In the case of a negative production externality, the social marginal cost is greater than the private marginal cost because there is a marginal damage that is also included. So, the social marginal cost is equal to the private marginal cost plus the marginal damage because the society is not just paying the private marginal cost, but it is also paying the marginal damage because of the use of this particular good.

So, MD here is the marginal damage. So, SMC or the social marginal cost is a private marginal cost plus the marginal damage. Now, why are we incorporating this private marginal cost? Because the society will be paying this amount for the production. Now, when we talk of production we are not just saying that the industry is producing things the society is also producing something.

Ultimately this is a decision that has to be taken by the society at large. Do we want pens to be manufactured by this particular process? Now, remember that we had said that a society's level of being or the living standards are decided by the amount of production in that particular society.

So, the society wants this particular good to be manufactured because it wants to raise the standard of living of the people who are living in this particular society. Now, to raise the standard of living, they will have to produce more. And when they are producing more, there is a cost involved in production and there is a cost of the marginal damage that is being made.

How does it look on the equilibrium curve? Now, this is our normal equilibrium curve. So, we

have a demand curve and we have a supply curve. And where the demand and supply are needed we have the equilibrium point that gives us the equilibrium price, and that also gives us the equilibrium quantity that is demanded or supplied by this market.

In the case of a negative production externality, if we do not consider the externality at all, then this curve will tell us the market equilibrium. So, here s is the private cost or the cost of production. Now, you will remember that the supply curve is given by the cost of production of the goods to the seller which is what we are seeing here. The cost of production is giving us the supply curve.

The demand curve is given by the private value that people are putting for this particular good. Now, in this example, the value is given by the amount a person is willing to pay for this particular pen. So, here we are observing that we have the private cost, and we have the private value that is giving us the demand and supply.

But when we consider the externality, then this private cost becomes the private marginal cost for each point on the curve. And there is a marginal damage that is also incorporated. And so we have a social marginal cost. Now, the social marginal cost at any point is the private marginal cost plus the marginal damage. So, the cost at this point plus the damage will give us the social marginal cost.

Because there is an increase in the cost because we are also looking at the cost of marginal damage. So, whenever there is an increase of cost, the supply curve shifts to the left which is what we are observing here. So, the supply curve in this case has shifted to the left. And the amount of this shift is given by the marginal damage that we have. So, in the case of the equilibrium considering the negative production externality, there is a shift in the supply curve.

Now, let us have a look at the benefits. Here we can talk about the private marginal benefit, and the social marginal benefit. Private marginal benefit is the direct benefit to the consumers of consuming an additional unit of the good by the consumer which means that as a buyer if I purchase this pen, what is the amount of benefit that I am getting is the private marginal benefit, the direct benefit to the consumers of consuming an additional unit of the good by the consumer.

And we also have the social marginal benefit, the private marginal benefit to the consumers minus any cost associated with the consumption of that good that is imposed on others. Now, in the case of the negative production externality such as manufacturing a pen with the polluting process, if I am purchasing a pen, I am not putting a cost on others by using this pen because the cost has already been imposed during the manufacture.

When I am using this pen and we in this case we are not talking about the pollution that will be spread, then I throw this pen out into the dustbin. But while I am consuming the goods, from the time that I purchase this pen and till the time I am writing with this pen, I am not imposing any cost on others because of this consumption.

If there is a cost that is involved, then we will have a difference between the social marginal benefit and the private marginal benefit. But in this case because it is a negative production externality only the social marginal benefit is equal to the private marginal benefit because no costs are imposed by the consumption of the good. So, in this case, the benefit curve and the demand curve is given by this D where private marginal benefit is equal to the social marginal benefit.

And there is a deadweight loss that is involved. So, what are we observing here? If we for instance take a quantity of this much, now what we are observing is that the benefit of this particular quantity of goods is given by this point where the quantity line the vertical line is intersecting with the demand curve. Now, the demand curve is giving us an indication of the value of this particular good.

It is giving us an indication of the welfare or the surplus that it will provide to the buyer. Now, in this case, the cost to the society is given by this point where the quantity curve which is the vertical line is intersecting with the social marginal cost curve. In this case, this is the benefit and this is the cost. So, it means that the benefit is greater than the cost.

So, the benefit is greater than the cost. Now, if we consider a point, say here, so this is the quantity that we are looking at Q. Now, at this quantity, the cost to society is this much. This is the cost to society. And the benefit to the society is given by this point, where it is intersecting with the demand curve and this is the benefit.

What we are observing here is that the cost is greater than the benefit. So, for this point, we have here we have cost greater than benefit. Now, in the case of economics, we had begun with our assumption that everybody is a rational decision maker which means that if the benefit is greater than the cost, then the decision to manufacture the good should be taken, but if the cost is more and the benefit is less than the society should not allow the manufacture of that particular good because it will cost the society more, but the benefit that the society gets is less.

Essentially, what we are saying here is that at this equilibrium quantity which is the optimal equilibrium quantity, this is the amount of goods that should be made or demanded or supplied, where the social marginal cost line is cutting the benefit line. But in actuality what is happening is that we are having this much amount of good that is being demanded or supplied, because this quantity we were getting when we were internalizing the externality.

This is the point which we are getting when we are not internalizing the externality. So, what is happening is that there is a deadweight cost involved. The deadweight loss is created for the society because some units are being produced and consumed for which the cost to the society is greater than the benefit to the society, or the social marginal cost is greater than the social marginal benefit.

This is the deadweight loss that gets created because of the negative production externality because for all of these units the cost given by the social marginal cost is greater than the social marginal benefit. So, this is the deadweight loss in the case of a negative production externality.

We can also have a negative consumption externality. When an individual's consumption reduces the well-being of others who are not compensated by the individual such as consumption of cigarettes. So, if somebody is consuming cigarettes, the people who are sitting around him or her are also becoming passive smokers, they will also suffer the health consequences of inhaling the smoke that is arising because our actor is consuming the cigarettes.

These people have got nothing to do with this person having the cigarettes, but they will have to suffer the consequences. So, it is a situation where an individual's consumption is reducing the well-being of others who are not compensated by the individual. So, in this case, the people who are becoming passive smokers and who will have to suffer the health consequences, they will not

be paid by the person who is consuming the cigarettes.
It becomes an uncompensated loss to others which is why it is a negative externality, and it is arising because of consumption. It is a negative consumption externality. Partying with a loud noise, now, in this case the people who are doing the party, they are having all the fun.
They are consuming the loud noise, but the consequences are suffered by the people who reside nearby because they do not want to have that loud music and a number of those people might also suffer because of the loud noise.
They will not be able to sleep properly if it is their sleeping time or they might suffer from certain health impacts. It is an increased hypertension. Now, this is a cost that the people who are doing the party are imposing on others and they are not compensating for it. So, they are not going to go to the others' homes, and pay the same amount for the cost of their treatment of hypertension.
Or consumption of SUVs - the sports utility vehicles. Now, these are large size vehicles that emit a large amount of pollution. So, they impose a cost on the society in terms of global warming, because they are consuming more fuel. And this fuel will get burnt and it will increase the amount of greenhouse gases that we have in the atmosphere. So, each SUV is doing a small bit to increase global warming.
Now, this cost is being imposed - the cost of global warming or the cost of climate change - is being imposed on the society by the people who are using these gas guzzling vehicles, but these people are not paying the society back or they are not compensating for the damages. So, it is an externality.
It causes damage to the roads because of a higher weight, but then these people are not going to pay extra for the maintenance of the roads. They lead to more insecurity to other vehicles due to their higher momentum. So, if there is an accident with two light vehicles, then the amount of damage that anybody suffers is less. In the case of an SUV because of its large weight, the momentum is higher.
And so the damage that it can cost to another vehicle is also higher. Now, this cost of the probability of having a higher damage is not being compensated by the owner or by the user of the SUV. So, this is a negative consumption externality. Now, in this case, again we can talk about the private marginal cost and the social marginal cost.
And the definitions are the same. The direct cost to the producers of producing an additional unit of the good is the private marginal cost. And the private marginal cost to the producers plus any cost associated with the production of that good that is imposed on the others is the socio marginal cost.
Now, in this particular case, we are not talking about the cost caused by the production of the SUV. We are only concentrating ourselves with the damage that is caused by the consumption of the SUV. And so in this case, we will say that the social marginal cost is equal to the private marginal cost because there are no costs that are being imposed by the production of goods.
We are not considering any cost in the production of the SUV, we are only concentrating on the cost of consumption, and so we will say that for our analysis SMC is equal to the PMC. Which means that when we talk about the equilibrium and when we are not considering the externality,

we have a private cost and we have a private value.
And in the case of the negative consumption externality, we are saying that the private marginal cost is equal to the social marginal cost. There is no change in the cost of production which means that there is no change in the supply curve. We are saying that there is no change in this green line.
On the other hand, when we look at the private marginal benefit and the social marginal benefit, the private marginal benefit is the direct benefit to consumers of consuming an additional unit of a good by the consumer that is the benefit that the person who is using the SUV is deriving out of using the SUV is the private marginal benefit. The social marginal benefit is the private marginal benefit to the consumers minus any cost associated with the consumption of the goods that are imposed on the others.
What we are saying here is that we have the social marginal benefit which is the private marginal benefit minus the marginal damage that is being caused by the consumption of an extra unit of SUV or by the consumption of an extra cigarette, or by consumption of an extra minute of loud noise. So, all of these are leading to marginal damage. And if we subtract that marginal damage from the private marginal benefit, we get the social marginal benefit.
What we are saying here is that the benefit to society in this case is not equal to the sum of the private benefit of everybody. It is the sum of the private benefit of everybody minus the marginal damage that this consumption has caused. So, if you look at the society in total, there is a benefit because of the use of the SUVs, there is a cost because of the use of these SUVs. And if you subtract the cost from the benefit, you get the net benefit which is the social marginal benefit.
In this particular case the margin because the social marginal benefit is less than the private marginal benefit. So, the curve will shift to the left. So, here we are observing that there is a change in the demand. And the demand is shifting to the left. And how much will this curve shift to the left is given by the marginal damage that is being caused by the consumption of an extra unit of this particular good.
So, we have a situation where the social marginal benefit is equal to the private marginal benefit minus MD. The social marginal benefit is less than the private marginal benefit and the difference is MD or the marginal damage. Now, when you have such a situation when the social marginal benefit is less than the private marginal benefit, then it creates a situation where you are having more amount of consumption than is the socially optimal level of consumption.
What do we mean by that? If we look at this curve and if we consider a point here, now the cost to the society is given by this point, the benefit to the society is given by this point. So, in this case, the benefit is greater than the cost. And for all the points to the left of this point, we will find that the benefit is greater than the cost. But at all the points to the right of this point, we will have a situation where the cost is given by this point which is there on the S-curve or the social marginal cost curve.
This is the cost, and this is the benefit that the society is getting. Now, in this case for all the points to the right of this point, we will have a situation where the cost is greater than the benefit. What does that mean? Remember that in economics we say that people are rational decision makers.

As a society, consumption of an extra good is leading to a cost which is greater than the benefit. In that case, that amount of goods should never have been produced because by not producing that good or by not consuming that good, the society can increase its total surplus.
The aim of the market was to enhance the social surplus of all the buyers and of all the sellers together. But, in this case, we are observing that we are consuming certain goods for which the cost is greater than the benefit. This leads to a deadweight loss situation.
A deadweight loss is created for the society because some units are being produced and consumed for which the cost to the society exceeds the benefit to the society. So, the social marginal cost is greater than the social marginal benefit.
And the quantum of this grade weight loss is given by this gray colored triangle. The actual social optimum quantity should have been this much, but the quantity that is being produced is given by this point when we are not considering the externality. All of these gray portions become deadweight loss.
We can also have situations of positive production externality. Positive production externality occurs when a firm's production increases the well-being of others, but the firm is not compensated by those others. Examples: a firm digging canal is paid for digging, but also benefits the farmers.
When they give a firm a contract to dig a canal, then we will only pay the firm on the basis of the amount of earth work that the firm is doing. The amount of earth that it has dug and removed to create the canal is the amount that we are going to compensate the firm.
But when the canal is dug then it also increases the agricultural productivity of the surroundings because now people have more water for irrigation of their crops. Now, this has an effect on the bystanders - in this case the bystanders are the farmers of the surroundings.
Now, those farmers were not paying for the digging of this canal, they did not pay the firm. But they are reaping out the benefits because of the action that the firm did. And the firm did not receive any compensation for the benefits that it provided to the farmers. This is an example of a positive production externality. It is positive because it is providing a positive impact on the bystander.
It is a production externality because this externality arises because of the creation of something, the production of the good. So, this is a positive production externality. Now, when the firm income increases, the standard of living in the surroundings may increase which will then also reflect in the nutritional status of children.
It will reflect itself in the educational status of the surroundings. Now, all of these positive benefits are being provided for by this company, but it is not receiving any um compensation for these positive impacts so which is why this is a positive production externality.
Another example is a firm that is doing mineral exploration because it also paves way for other firms once the mineral is found. In this case, there is a firm that is doing mineral exploration, and it is being paid for only the amount of exploration that it does, that is it is being paid for how many square kilometers of area it has explored.
But when there is the discovery of an important mineral in that area and important ore in that area, then it will also result in huge amounts of employment because there will be other firms

that will come to this area once the ore has been found. And they will extract this ore and in the process, they will also provide a large quantum of employment.

Now, the firm that was doing the exploration is not getting paid for the development of a surrounding that will happen if it is able to find out an ore so which is why this is a positive production externality it is bringing in a positive impact in the terms of employment or in terms of the total production of a country or in terms of the living standards in a country. So, these are the positive impacts that are being brought about by the firm that is in mineral exploration.

And this is a production externality because it has got nothing to do with the consumption aspect. The firm is only doing a production activity in terms of the service that it is providing. But because of this production it is giving a positive impact on the bystanders that is to say the people who will get jobs because of the extraction of these minerals, and the firm is not getting paid for that it is not getting compensated for that which is why it is an externality.

In such cases, we can talk about the private marginal cost and the social marginal cost. Now, private marginal cost as we have seen before is the direct cost to the producers of producing an additional unit of a good which means that in the case of the firm that was digging the canal, it is the cost of how much does it take to say dig an extra kilometer of the canal.

The direct cost to the producer is the direct cost to the company that is digging the canal of producing an additional unit which is say 1 kilometer of the canal. Then we also have the social marginal cost. The private marginal cost to the producers plus any cost that are associated with the production of the goods that are imposed on the others.

Now, in this case, the positive in the case of positive production externality we have social marginal cost equal to the private marginal cost plus the cost of production of goods that is imposed on others, in this case this is a negative figure. So, we get SMC is equal to PMC minus the marginal cost or plus the marginal benefit.

What we are saying here is that the social marginal cost is equal to the private marginal cost plus the marginal cost that is imposed on others. In this case, the cost is negative because it is a benefit, it is actually not a cost. So, this becomes a private marginal cost minus the marginal benefit that this production is providing to others. So, SMC is PMC minus the marginal benefit.

In this case, the society has to pay less of a cost because it is paying for the cost of taking minus there should be also a deduction for the benefit that this activity is given to the society. For instance, if I were to purchase this pen, and I am paying 30 rupees for the purchase of this pen, but I am getting 10 rupees back. So, in that case, the cost that I am paying for this pen is 30 rupees that I am paying minus the 10 rupees that I am getting back in the form of the benefit.

The social marginal cost in this case is the private marginal cost minus the marginal benefit. So, how does that affect the equilibrium? So, this is our normal equilibrium. And when we are not considering the externality, we are only talking about the private cost and the private value. But, in this case, the cost to society is less. The social marginal cost is equal to the private marginal cost minus the marginal benefit. It is costing society less to manufacture this good.

Now, if you look at the benefit or the demand side, then we have the private marginal benefit and the social marginal benefit which is what were defined as before. But, in this case, there is no cost that is imposed by the consumption of the good. So, if the society is consuming an extra

kilometer of the canal, then there is no cost involved in consuming the canal or in getting water from the canal.

In this case, the social marginal benefit is equal to the private marginal benefit because there is no change in the demand curve which is what we are showing here. What is happening in this case is that the society is paying for the taking of the canal, but it is also receiving a value in terms of the positive externality that is accruing because of the taking of the canal.

So, the society paid 30 rupees, but it got 10 rupees back in terms of the other benefits. Another example is if I purchase this pen for 30 rupees, I get this pen which is worth 10 rupees free with it. So, the cost that I am paying for this pen is 30 rupees minus this 10 rupees is what we are saying here.

The social marginal cost reduces by this amount of marginal benefit, but there is no change in the social marginal benefit because of an extra unit of the canal. So, the demand curve remains the same. The supply curve shifts to the right. Now, why is it shifting to the right? Because it is costing society less to manufacture the canal. So, if the cost of production goes down, then the supply curve shifter shifts to the right.

Now, in this case as well we can observe certain deadweight loss. A deadweight loss is created for the society because some units are not being produced and consumed for which the benefit to the society exceeds the cost to the society which means that if we consider the externality then the optimum quantity is this much where the red curve and the demand curve are intersecting.

But when we do not consider the externality, the optimum quantity is given by this intersecting point. So, these products from here to here are not being manufactured. Even though for each of these the cost to the society, say, if we consider a point here the cost to the society is this and the benefit to the society is this.

So, we have a benefit that is greater than the cost, but still we are not manufacturing this because we did not consider the impact of the positive externality. So, this is a deadweight loss given by this gray colored triangle. Then we also have a positive consumption externality. When an individual's consumption increases the well-being of others but the individual is not compensated by those others.

The individual is consuming something. This is a consumption externality where an individual is consuming something, but through it his or her consumption there is also an increase in the society's well-being or in the well-being of a bystander which is why it is an externality. And this is a benefit, so it is a positive impact. So, it is positive consumption externality, externality.

Examples include vaccination because they stop the spread of infections to even those people who are not getting themselves vaccinated. Or education of children because when children are educated when people in a country are educated, then it also has benefits to all the members of the society in terms of not just a better political thought process, but also because these educated people will probably later on start other industries that provide jobs to more people.

So, education is also a positive consumption externality. But then the society in most cases does not pay for this education, there are very few instances in which education is subsidized by the society. Now, when the society subsidizes, then it will become internalization of the externality, but it hardly happens.

Or, landscaping of one's garden. If you keep your garden clean, if you keep your garden landscaped, then that increases the value of the property of others in the society as well because it looks like a more beautiful society to live in. But then others do not pay you for landscaping your garden. So, this is a positive consumption externality because you are consuming by having a better garden, so that is your consumption. It is causing an externality which is positive.

So, it is a positive consumption externality. Now, in this case, because we are only considering consumption, the cost of production or the supply curve will not change which means that SMC is equal to PMC as before. So, this is the equilibrium not considering the externality. So, we have the private cost and we have the private value.

Now, in the case of positive consumption externality, there is no change in the cost of production. So, there is no change in the supply curve. The supply curve remains as before which is given by S is equal to PMC is equal to SMC. But, in the case of the demand curve, we have the social marginal benefit is equal to the private marginal benefit plus a marginal benefit that this externality is providing.

The society is getting this extra benefit from this activity or this good that is being consumed, and so the total benefit of the society increases. When that happens, we can observe that there is a shifting in the demand curve that should occur towards the right given by this difference of marginal benefit.

Once this happens, what we can observe is that earlier this much amount of equilibrium quantity of goods was being produced, whereas, if we internalize the externality, this much amount should be produced. Because if we consider any point in between let us say this quantity, now at this quantity the benefit is given by this point. This is telling us the amount of benefit that the society is getting. This is telling us the cost to society.

Now, if benefit is greater than the cost, then this good should have been produced, but what is happening is that because we are not considering that into the equation. We are not producing these or consuming these quantities. So, a deadweight loss is created for the society because some units are not being produced and consumed for which the benefit to the society exceeds the cost to the society. And here the deadweight loss is given by this curve in gray color.

To summarize, the externality is the uncompensated impact of a person's actions on the well-being of a bystander. And we have four different kinds. We can have negative or positive externality, and we can have production, or consumption externality.

That is all for today. Thank you for your attention. Jai Hind!

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Module 8
Public sector and Conservation
Lecture 2
Public goods and common resources

Namaste! We carry forward our discussion on Public Sector and Conservation and in this lecture, we shall explore public goods and common resources. Let us begin with a recap. We saw that externality is the uncompensated impact of one person's actions on the well being of a bystander. Now, externality is going to be a very important factor in this lecture as well. Externality is the uncompensated impact of a person's actions on the well being of a bystander.

So, somebody is doing something, but that action is also impacting other people who have got nothing to do with that decision or that action and they are also not getting compensated for those impacts in that case we say that it is an externality, and it is of four kinds, you can have negative or positive externality.

In the case of negative externality, the bystander is negatively impacted. In the case of positive externality, the bystander is positively impacted, that is he receives a benefit. Production externality occurs when the actor is producing something such as the mining industry and consumption externality occurs when the actor is consuming something so, it is a polluting vehicle.

When you have externalities and there isn't an uncompensated impact on the bystanders, how do you deal with them? So, we have different options to compensate for the externalities. They include public sector solutions and the private sector solutions. One solution is the use of regulation.

Regulation means that the government says that dumping waste into a river is a crime. So, if anybody is dumping the waste, then he or she is going to be jailed. Now, this is one way of ensuring that the rivers do not get polluted. So, by means of laws and by means of enforcing those laws, we ensure that the rivers do not get polluted so that the bystanders are not negatively impacted. So, this is one way: regulation.

Another is corrective taxes. A tax designed to induce private decision makers to take into account the social costs that arise from a negative externality. Now, corrective taxes also go by the name of Pigouvian taxes. Now, corrective taxes or Pigouvian taxes are a tax designed to induce private decision makers to take into account the social cost that arise from a negative externality.

It means that if there is a negative; a negative externality, the government is going to put a tax on such an action so that it becomes more expensive to do that action that is having a negative externality. That is the use of corrective taxes.

An example is corrective taxes for pollution. In this case, what is happening is that we have a price for pollution and we have a quantity of pollution and there is a demand for pollution or a demand for pollution rights.

What this curve is telling us is that there are certain industries who want to be able to pollute the environment because say there is a factory and when the factory is run, then it would give out certain amounts of a smoke or if the when the machines are running, then it would give out certain amounts of noise.

The thing here is that the person who is owning this firm or the factory wants to make this pollution because by making this pollution, he is earning something, he is earning a profit so, he requires the right to pollute the environment with sound pollution, air pollution or any form of pollution, but then the demand for for these pollution rights, this is also like any other demand for any other good in the market. So, there is also a price involved.

If you tell the factory owner that ok, you can pollute the environment if you pay 10 rupees for it every day, then probably the factory owner would say ok this is a small amount, what do I have to do with it. I will pay 10 rupees to the government and I will pollute as much as I want. But then, if the government says that ok, if you want to pollute, then for every unit of the pollutant that you are releasing, you will have to pay 50000 rupees.

Now, this person would start to think ok, am I earning enough to be able to buy this pollution permit for 50000 rupees probably not and if I am not earning enough money by running this industry and polluting the atmosphere, then probably it does not make sense for me to buy this pollution permit. His demand would reduce. If the price is too high, then probably the demand would be obliterated which means that at a very low price, the demand for pollution rights will be very large.

When price increases, the demand would reduce. Probably some people would want to reduce the amount of pollution that they are spreading by installing a pollution controlling device, but when the price increases very much, the demand will be very little. So, we are observing the law of demand that as the price increases, the quantity demanded reduces.

In this case, what the government is doing is that the government is setting up a price through this corrective tax. If this price is increased or decreased, that is what we are saying is that if the price is set at this point so, this would be the amount of, this would be the quantity of pollution that will be demanded. If the price is kept very low, then the quantity demanded will be very high.

This will be the quantity that is demanded. At this lower price, when the price is low, then greater quantity is demanded, when the price is high, then a lesser quantity is demanded. In this way, by setting a price through the corrective taxes, the government can regulate the quantity of pollution that is being spread into the environment.

Pollution is an externality because the factory owner is earning the benefits, he is earning the profits, but the people who live in the surrounding they have to bear with this pollution and they have to pay the cost specially, the health cost, the cost of living in a polluted environment, the cost of having to bear with all the smell.

Because this is an externality, the government may make use of this corrective tax and in this

case, the government is not putting this tax to earn revenue. Now, this is the most important concept here. The government is not putting this corrective tax so that it can earn more revenue, the government is only putting this corrective tax to deter people from polluting.

This tax is only acting as a disincentive to the factory owners from polluting and similarly, the government can use these corrective taxes to control any behavior that has a negative externality. So, if the government thinks that ok, if people smoke, then the; then the people who are there in the vicinity become passive smokers and they have to bear the health cost.

So, what will the government do? The government can increase the price of cigarettes and how will the government increase the price of the cigarettes? By putting a corrective tax on cigarettes. In this case, the government is setting the price and the price is determining the quantity.

Another thing that the government can do similarly is to use corrective subsidies. In the case of corrective subsidies, the government provides money to certain activities that need to be promoted such as things like education or vaccination or health care.

When a person is vaccinating himself or herself, then they are also protecting the community from the spread of diseases. If people are more educated, then they are not just serving their own interests, but they are also serving the interest of the society by becoming more enlightened citizens.

These sorts of activities that have positive externalities, they are subsidized by the government as a solution of this externality. Another option with the government is to use things such as tradable pollution permits.

In the case of pollution permits, what happens is that the government sets the amount of pollution that can be done. In the previous case, the government was setting a price and this price was regulating the amount of pollution that will be released into the environment. In the case of tradable pollution permits, the government sets the quantity of pollution that can be spread.

In this case, what happens is that the government will give out certain permits and with each permit, a person is allowed to emit a certain amount of pollution. Let us say that there is a pollution permit and with each permit, a person can release 1 ton of carbon dioxide and the government what it is doing now is that the government is saying that ok, if you want to emit carbon dioxide from your factory, you will need a permit, but we are only going to issue 10 permits which means that a maximum of 10 tonnes of carbon dioxide can be emitted.

Now, what happens? Here as well, you have the demand curve for the pollution rights. But now, the quantity has been set and once we have the quantity, this quantity will determine the price that the people will be ready to pay for these pollution permits. Now, these pollution permits can be sold through an auction.

When these 10 pollution permits are sold through an auction, then those people who have the highest demand for these pollution rights, people who pay who who have a very high amount of value to these pollution rights, they will be buying these pollution permits at a higher price and those people who do not put a very large value or who do not want to shell out that much amount of money, they will not get the pollution permits.

The government can even go one step further by stating that let the private parties also trade these pollution permits amongst themselves. What happens in that case is suppose there are 10

firms, and the government has sold 1 tonne permit to each and suppose 1 permit is costing rupees 1 lakh. We have these 10 firms A, B, C, D, E, F, G, H, I, J so, these are the 10 firms, and they all have the permit for 1 tonne of carbon dioxide emission.

But what now happens is that this firm G, thinks that 1 tonne of permit is not enough for me probably, I would want to go for 1.5 tonnes. Now, in this case, because it has a permit with itself only to emit 1 tonne of carbon dioxide, if it emits 1.5 tonnes of carbon dioxide, it will be penalized probably, the owner might go to jail.

Now, the option with this firm G is that it will ask everybody else in the market whether anybody has an excess of the permit as compared to their requirements. Suppose firm B bought 1 tonne permit, but it is only going to need 0.8 tonnes when it is doing its production. In this case, it can sell off 0.2 tonnes that remains to this firm G.

What is the rate at which it will be selling these 0.2 tonnes? It will not be this rate, at this rate, it would have costed only 20000 rupees, but now that firm B knows that firm G desperately needs these pollution permits probably, it is going to sell them for a bit more. So, in place of 20000 rupees probably, it will be charging it say 25000 rupees.

Because G desperately needs more pollution permits, it will be ready to pay say 25000 rupees, but then, when these pollution permits are getting traded, then this will also result in certain impacts on the other firms. Probably, firm I will think that ok, I have this 1 tonne permit and I bought it for 1 lakh of rupees, but now the price has appreciated so, from 20000, it has increased to 25000 so, there is an increase of 5000 every 20000 is 25 percent increase in the price.

Now, firm I will think that ok, I have this thing that is worth 1 lakh of rupees, that is I have paid 1 lakh of rupees for it, but I can sell it off for 125000. So, let me figure out if there is a way that I can reduce the amount of pollution in my firm so that I am also left with certain excess. That is because the price has increased in the market because of free trading so, now, this firm will also try to reduce its emissions.

In this case, the government is not forcing this firm to reduce the emissions, but what is happening is that because of the market mechanism and looking at everyone's self-interest, now in this case, the firm I is not thinking that if I am releasing pollution, then it is harming the environment or it is creating an externality to the people in the surroundings no, they are only looking at their own self-interest and in this case, firm I is thinking that if I can reduce my amount of emission, then probably I can sell my permit at a premium.

Probably it will also try to cut down its pollution and so, in place of say emitting 1 tonne of carbon dioxide probably, it is able to; it is able to bring it down to 0.9 tonnes and in that case, it can sell the remaining 0.1 tonnes to the firm G. So, what is happening in this case is that the government is not putting a price to the pollution as it was doing earlier.

Earlier the government was setting the price through means of taxation. In this case, the government is just saying that ok, this is the amount that we are going to permit and whoever has a higher requirement, whoever values the right to pollute more is going to pay more and if there is still a shortfall.

We can even permit the players to trade amongst themselves, the government only needs to enforce the rules to see to it that nobody is able to pollute without a permit and the market mecha-

nism will take care of everything else. Now, in this case, we have a solution to the problem of externality. The government wanted to reduce the externality in the form of pollution and this is one way of doing it.

The government may go even a step further. The government may say that ok, this year we permitted 10 permits, but next year we are going to permit only 9 so, when there is a gradual reduction in the number of permits that will be issued, then slowly and steadily, those firms that are in a better position to cut down their pollution, they will take hold of this opportunity and cut down their pollution.

In this case, not every firm is cutting down its pollution because there could be certain firms such as a cement firm that has little options to cut down on the amount of carbon dioxide that it releases because during the production of cement, calcium carbonate has to be heated and that will release carbon dioxide.

There is a limit to which it can bring down its carbon dioxide emissions, but at least those firms, say a firm that is working in the energy sector, may at least bring a few of its coal-based power plants down and probably shift to solar energy or wind energy.

So, those firms that are in a better position to cut down on pollution will do so and they will trade these pollution permits with those firms that are not that good at reducing their pollution and slowly and steadily, the government can control the amount of pollution. So, this is another way in which the externality can be regulated.

Other solutions are the private sector solutions. Moral codes and social sanctions: social boycott of those who are doing pollution. So, in this case, the government is not needed, but what is happening is that the society is boycotting these firms that are doing pollution and probably the society is encouraging those people who are cutting down the pollution, showing an exemplary way of cutting down pollution.

Another option is charities, giving money to those organizations with positive externalities. Schools and colleges and research institutions. This is another way in which the government is not needed, but if people in a society find that research institutions are good for the society because they are going to increase efficiency, they are going to lead to better health care, better education.

In that case they can themselves provide a certain amount of money to these institutions. Integration of businesses such as orchard and apiculture together to reap maximum benefits, contracts and bargaining. So, these are all different solutions to externalities.

And here we also looked at the Coase theorem. The proposition that if private parties can bargain without cost over the allocation of resources, then they can solve the problem of externalities on their own. Now, this is something that we have seen before, but the important thing in the Coase theorem is that it does not matter who has the upper hand whatever be the situation, the private parties can come to a solution to the externalities, and they are able to bargain without cost.

Let us look at the case of a steel plant that is polluting the river and this pollution is reducing the fish catch. Now, here again for the Coase theorem to work properly we need to have property rights and we need to have a government that can help in the enforcement of property rights. We will look at two cases.

The 1st case is that the river belongs to the fishermen. The government has given the right of the river to the fishermen. So, they exert a right on clean water, and they threaten to close the steel plant. Now, in this case the fishermen go to the steel plant owner and say that ok, this river belongs to us, you cannot pollute this river, if you do this, we are going to enforce our property rights and we are going to shut you down.

Now, in this case, when both these parties can bargain together, the steel plant owner can tell these fishermen that ok, your catch is getting reduced because I am spreading this pollution, but then, there has to be some rupee value or dollar value to the amount of cash that does not go down.

What he is saying is that suppose earlier, you were earning 20000 rupees because of your fishing operations, but because of my pollution, now, you are earning only 10000 rupees and because you are earning 10000 less so, you are telling me that you are going to close the plant, but I have a better solution. So, the steel owner says that let me pay you 11000 rupees and you let my plant to work as before.

In this case, the the plant owner is at a profit because probably, he is manufacturing a steel that is worth lakhs of rupees and he only has to pay 11000 rupees and the fishermen are also at a benefit because earlier, they were earning 20000 rupees, now they will be earning 10000 rupees from fishing and getting 11000 rupees as compensation. In this way, through bargaining, both these parties can come to a solution that can benefit both of them.

Another option is when the river belongs to the steel plant. Now, in this case, the fishermen are concerned about the reduced catch so, what is happening is that the fishermen, they find that their catch has gone down by 10000 rupees and because the steel plant owner is also owning the river, he can pollute as much as he wants. So, now, what these people will do is that they will tell the steel plant owner that we are going to pay you something.

What they will say is that we are going to pay you say 5000 rupees to install pollution control equipment. What the fishermen are doing in this case is that the plant owner because he owns the fish and he is in no mood to pay for the cost of installation of the device, what the fishermen would do is that they will install the device for the plant owner and in this case, the machine is going to bring down the pollution.

What is happening here is that they can either install the equipment or they can pay to the steel plant owner and say that ok, you please reduce the amount of pollution that you are causing, and we are going to pay you for that. So, you give us this service of reducing pollution and we are going to pay you for the service.

What we are observing here is that whether the river belongs to the fishermen or whether it belongs to the steel plant owner, in both the cases, the parties can bargain amongst each other and come up with a solution, that is the beauty of the Coase theorem. Whether the property belongs to any one party, the both the parties if they are able to bargain without cost over the allocation of resources, they can solve the problem of externalities on their own.

Essentially, what we are saying here in the case of externalities is that markets are usually a good way to organize economic activity because as we have observed people can do trading of pollution permits, people will go with Coase theorem and solve the problem of externalities, but if that

does not happen another option is that governments can sometimes improve the market outcomes as in the case of corrective taxes.

Other kinds of goods are public goods and common resources. Let us look at this case: The village that Shyam lives in is surrounded by grasslands. The grassland can support 200 cattle. Each person in the village has a right to graze his or her cattle in these grasslands which means that there is no private property as far as grasslands are concerned, any person can take their cattle to the grasslands for grazing.

The village has 20 people, each of them have 10 cattle which means that the total number of cattle is 200 and the grassland can support 200 cattle. So, basically the grassland can support 200 cattle and there are already 200 cattle in the village and Shyam is thinking of buying one more cow. What is his cost in benefit given that the grassland is already supporting the maximum number of cattle and will he buy?

Essentially, there is a grassland, and the grassland can support 200 cattle, there are already 200 cattle, and we have one person in this village who is thinking of buying one more cattle. Now, in economics we consider that people are rational thinkers. Now, if Shyam is a rational thinker, what would he think? He would think that ok, if I get one more cattle, then the total number of cattle will be 201, but the grassland can only support 200 cattle.

Now, the grassland is not an entity that will only permit 200 cattle to get inside and will leave out one cattle, but what will happen is that each of these 201 cattle will be eating a little less. In this case, suppose one cattle can give 10 liters of milk. Now, every cattle because they are getting less amount of feed so, every cattle will be giving out less amount of milk.

Let us say that every cattle in place of giving 10 liters of milk will give 9.8 liters of milk, but then the one cow that I am going to bring that is also going to give me 9.8 liters of milk. What it means is that earlier, Shyam had 10 cows and each of them was giving 10 liters so, in total it is 100 liters of milk that he is getting.

With one more cattle, he will be having 11 cattle and each of them will be giving 9.8 liters of milk. What is the total amount of milk that will be produced for Shyam? It will be 107.8 liters. Now, the thing here is if Shyam only kept 10 cattle, he was getting 100 liters of milk.

But when Shyam gets the 11th cattle, he is now getting 107.8 liters of milk which means that his production has increased by 7.8 liters and the cost of having this cattle is being borne by all the other people because they will be getting a slightly less amount of milk.

Now, this kind of a resource is known as a common resource. So, this is a common property, there is no private uh property rights in this grassland and a common thing with common property is that people tend to over utilize them and remember that this sort of a thinking is coming from a rational decision-making process, it is not that Shyam is irrational.

Even though Shyam knows that 200 cattle is the maximum that can be supported, he would still want to have one more because it is in his own benefit. Now, in this case, we are not talking about an externality because it is having a negative impact on everybody else that is fine, but what we are talking about is what is the impact on the resource?

Now, when Shyam gets this extra cattle, he also knows that it is possible that because of overgrazing, the grassland itself will be destroyed, but then, the destruction of grassland will take

some time so, it will be a long-term process and in the long-term, we are all dead.
So, everybody is doing short-term thinking and so, Shyam will get one more cattle and we will have a similar thought process with every person in the village so, every person would want to have one more cattle, but when that happens, the overall common resource gets destroyed.
Another kind of resource can be understood with this example. The society that Ram lives in has decided to go for beautification and is collecting funds for it. In this process, the walkways will be cleaned and paved, and on both sides, trees will be planted. The contribution to this fund is voluntary. Will Ram pay to the fund or not because whether Ram pays to the fund or not, he will benefit from the beautified surroundings. Now, the question is will he pay?
Because the thing is when the society is beautified, Ram is going to have all the benefits of that whether he pays or not because once the society has been beautified, once the pavements have been cleared, once you have these trees, then Ram is also going to enjoy the benefits, there is no way that the society can say that Ram is not allowed to use this benefit, the society cannot say that ok, Ram you did not pay so, you should not walk in the shade of these trees and you should not be using the pavements, the society cannot do that.
Now, in that case, it is in the interest of Ram if you look at a short-term rational decision-making process. Ram will think that ok, I should not pay because whether I pay or not, I am getting the benefits so, why should I pay. But when that happens and this; this sort of rational thinking will be there in the minds of everybody. Every person who lives in the society will have a similar thought process because this fund is voluntary so, why should I pay.
But when that happens, when nobody pays for the fund, then probably the society will not be beautified and so, Ram and everybody else in the society will continue to live in a dirty looking surroundings without these trees, without clean pavements, but it is being done through a rational decision-making process and things such as these are known as public goods.
And these sorts of things, the public goods and the common resources are at the heart of lacking efforts to save the environment and over utilization of natural resources because when we talk about Ram living in this society, it is very similar to saving the environment.
So, the thing is if we conserve the tigers, if we conserve our forest, we are all going to reap out the benefits. Everybody is going to have the benefits of biodiversity, but when it comes to payment, nobody wants to pay for these.
People want to have more number of roads, people want to have more electricity, but then people also want more biodiversity, people also want to have tigers, people also want to have tourism in their country, but they do not want to pay for that because the thing is if you do not pay for electricity, you do not get electricity, it is something that you can be excluded from, but the benefits of biodiversity cannot be excluded.
If somebody pays or not, they are going to get the benefits of biodiversity. So, it is a public resource, it is a public good and similarly, when we talk about polluting the environment so, everybody knows that the environment can only tolerate a fixed level of pollution and if we cross this threshold, then it is to the detriment of everybody, but still people go on polluting why? Because the environment, air, and water are all public, these are all common resources.
Even though the quality goes down, the quality goes down for everybody so, everybody will suf-

fer. If everybody is going to suffer, but I am going to gain from it, why should I not pollute is the sort of thought process that goes on in the minds of people. Which is why public goods and common resources are very important topics when we talk about conservation economics. These are cases where completely rational thinking destroys the environment.

And we have observed a number of such cases such as things like the Minamata disaster in which Chisso corporation just dumped untreated mercury containing toxic waste into the seas. Now, it is not that the people from the Kiso corporation did not know that mercury is bad for the environment, the thing is if we pollute the seas, then the cost will be paid by everybody, but the benefits will be gained only by us. So, why not pollute? That is the sort of thought process that goes on.

The smog of London. Everybody knows that if we are using fuel to heat the homes and we are using those fuels that are releasing pollution, that will lead to negative consequences, but the thing is negative consequences will be borne by everybody. But if I am using this fuel to heat my home, even though it is giving out a huge amount of pollution, but then, I am getting the heat so, I am gaining the benefit, but everybody is paying the cost so, why should I not gain the benefit?

A rational decision-making in these cases destroys the environment. Things like the release of toxic uh gases like dioxin, the dumping of waste into the Love canal, the Bhopal gas tragedy, these are all questions of conservation and rational thinking lies at the heart of them. What are these common resources, what are the public goods? Essentially, we can divide goods into four different categories depending on whether or not they are excludable and whether or not they are rivals in consumption.

Excludability is the property of a good whereby a person can be prevented from using it. So, when we say that a good is excludable, it means that one person can say that no, you cannot use this good, this good is mine or this good is ours and we will not permit you to use this good. So, you as a person can be excluded from using it.

A very good example is your home. If an outsider whom you do not know wants to enter your home, you will just say no, we are not going to permit you inside. So, your house is an excludable good, you can exclude people from getting inside. Private societies are excludable goods, you can exclude people from getting inside.

Your personal resources are excludable goods because you can always say that the pen that you have, you are not going to others; you are not going to permit others to use your pen, you can exclude them from using the resource that is the pen that is in your hands. The other criterion is rivalry in consumption. The property of a good whereby one person's use diminishes other for people's use.

When we say rivalry in consumption it means that if I consume the good, then you have less amount or less quality of that good available for consumption. A good example again is things such as forest. So, if I cut down a tree, then that and I take the timber away, then that timber is not available for your reuse. So, it is a rival in consumption. If I use more, you get less. If you use more, I get less. That is rivalry in consumption.

And using these two criteria, we have four different categories. The first one is private goods. Goods that are both excludable and are rival in consumption. Clothes, cake, ice-cream, congested

toll roads. So, if I have a cake and if I eat up this cake, then less of this cake is available for you to eat.

So, it is a rival in consumption. The more I eat, the less is; the less remains for you, but it is also excludable. I can say that this is my cake, I am not going to allow you to eat it. So, it is excludable. Goods that are both excludable and rivals in consumption are known as private goods.

Another example is congested toll roads. Because the road is congested it means that if one more vehicle gets inside, if I take my vehicle inside this road, then it becomes a rival in consumption because you have less of the road available for use. So, essentially, if I get into this road, your speed also reduces. The more I use this road, the less it is available for others and so, it is a rival in consumption.

But at the same time, it is also excludable because it is a toll road which means that we can say that we are not going to permit other people to use this road, if they do not pay for getting inside. So, it can be excluded. We can raise the price of getting inside too high so that people effectively cannot use the road at all. So, it can be excluded. So, congested toll roads are also private goods.

The second category is club goods. Club goods are those goods that are excludable, but they are not rivals in consumption. Things such as cable TV. Now, in the case of a cable TV, it is not a rival in consumption because if I have cable TV in my house and you have cable TV in your house and if I am using the cable TV, it does not stop you from using the cable TV, it does not reduce the quality that you are getting in your home, it does not reduce the number of channels that you get in your house.

So, this is not a rival in consumption. But it is excludable because the service provider can always say that if you do not pay so much amount to me, I am not going to give you the subscription. So, it is excludable, but it is not a rival in consumption. Things such as mobile subscriptions. Here again, if I have a mobile, you have a mobile, then both of us can use the mobile, but it can be excluded. So, people who do not pay the charges will not get the mobile subscription.

Fire protection: if my house is protected, it does not reduce the quality of protection of your house. If there is a fire and if we have a fire service, then you are also going to benefit I am also going to benefit so, it is not a rivalry consumption, but it is excludable because if a private company provides this service so, the company can always say ok, those people who pay for the subscription are going to get the fire services others are not going to get it.

Things such as uncongested toll roads. Now, here, it is a toll road which means that it is excludable. So, people can say that; that those people who are not paying the tolls will not be permitted so, it is excludable, but at the same time, it is not a rival in consumption because it is uncongested.

So, there are so few vehicles on this road at present that if a few more vehicles get inside that is not going to make any difference in the quality of usage by the people who are already inside. So, these sorts of goods are known as club goods.

Another category is common resources. Goods that are rival in consumption, but not excludable. Things such as fish in the lake. Now, fish in the lake is a rival in consumption because if I take out more of the fish, if I do more fishing, then less fishes available for you.

So, it is a rival in consumption, but it is not excludable in most cases because people have free

access to the lake. So, until and unless there is an authority that puts up a fencing all around this lake, it is not excludable, but it is a rival in consumption.

Things such as clean air, it is a rival in consumption because if I use the clean air and I pollute it in the process of using, then you will not get that amount of or that quality of clean air, but it is not excludable because one person cannot say that ok, this is my air, you are not; you are not permitted to use this air, it is there for everybody or congested non-toll roads.

Now, because this road is non-toll so everybody can use it, it cannot be excluded, but because it is already congested, the more people that get inside this road, that are using this road, the lesser the quality remains for the other people to use it. So, these are common resources.

Now, the issue with the common resources is the issue of the tragedy of the commons. A situation in which a shared resource where individual users, acting independently according to their own self-interest, behave contrary to the common good of all users by depleting or spoiling the shared resource through their collective action. It is a situation in which there is a shared-resource system.

So, the resource is shared which means that mean many number of people can use it and in in this tragedy of commons, there are these individual users who are acting independently according to their own self-interest and they are also doing a rational thinking, but in doing this rational thinking and in acting in their own self-interest, they act in a matter that is contrary to the common good of all the users.

So, by acting in their self-interest, they act against the interest of all the people, of all the users by depleting or spoiling the shared resources through their collective action. Good examples are overfishing and overgrazing. In the case of overfishing, all the individual users or any individual user while acting in his own self-interest would think that I should have more and more fish, I do not care whether these fish are being removed in a sustainable manner or not.

The only thing that I care about is how much profit can I make, how many fish can I take out, but when everybody does this, then the whole resource gets depleted, but in this case, everybody is acting in their self-interest, everybody is doing the rational thinking, but still the resource gets depleted. This is the tragedy of the commons.

And we have looked at this example that everybody in this village would want to have one extra cow, but when everybody is acting in their own self-interest, through rational thinking, acting independently they destroy the whole of the resource. So, this is a tragedy of the commons.

Now, there are certain solutions to the tragedy of commons. Things such as social arrangements. Now, in the case of the tragedy of commons, we said that individual users are acting independently.

Now, if we remove this term independently by putting in a social arrangement, now in this case, the social arrangement could say that ok everybody only gets 10 minutes to fish. Now, when you have such a social arrangement, then it is not possible for people to take out all the fish or for people to do all the grazing.

Basically what it says is that we have a grassland and in this village, we have 20 people all with 10 cattle and every person gets 10 minutes for their cattle to graze. Now, in this social arrangement what happens? If Shyam gets 11 cattle and he is only getting 10 minutes for these cattle to

graze so, what is happening is that in those 10 minutes because the cattle can only graze in a certain portion in this area so, his cattle will be getting less amount of fodder, but other people's cattle will be getting sufficient amount of fodder.

In such a social arrangement, we can ensure that people are acting in the benefit of the common resources as well. So, things can be regulated. Everybody getting 10 minutes for fishing with a specific size of net is again another social arrangement through which we can solve this problem or things like privatization.

In privatization, we can make this farmland a private resource. When it becomes a private resource, it becomes excludable and it becomes a rival in consumption. Now, it is already a rival in consumption, but by putting the clause of excludability, we can say that ok, if people have to bring in cattle inside, then for each cattle they will have to pay say 20 rupees. So, the people who are bringing in more cattle will have to pay more, this is another arrangement.

Or government regulation such as the UN convention on the laws of the sea. So, we can have regulation by the government as well about how these resources have to be managed. A very good example is the management of forests in our country. The supreme court says that a forest will be managed only according to a working plan and in the working plan.

The government makes a regulation about how many trees can be cut so that the extraction of timber happens in a sustainable manner, government regulation is a way to solve the problem of tragedy of commons. Another thing is internalizing the externalities such as tax on petrol which means that if because clean air is a common resource so, if the petrol is taxed higher so, in that case, the externalities are getting internalized.

The more one person is polluting by using a less fuel-efficient vehicle, the more they will have to pay. So, these are all different solutions to the tragedy of commons. Similarly, we have public goods. Goods that are neither excludable nor rival in consumption. So, you cannot prevent anybody from using this resource and these resources are not rivals in consumption which means that if one person uses this resource, then it does not reduce the quantity or quality of the resource or used by other people.

Good examples are things such as warning sirens. Now, if there is a siren that is blaring because a tsunami is nearby, then we cannot say that people who did not pay for this siren are not going to be permitted to hear it or if one person hears it, it does not reduce the quantity or quality of this resource for use by others because if one person is warned and other another person also hears it, he will be we warned equally well.

Or things like national defense. Now, if the nation is defended, everybody is defended, you cannot exclude somebody. It is not a rival in consumption because as citizens of the same country, if my nation is defended, then it does not reduce the quality of defense of you or your nation because we both belong to the same nation.

So, national defense is a public good. Scenic view, if a view is beautiful, then we cannot prevent people from seeing it and if one person has seen a beautiful place, then it does not reduce the quality or the beauty of that place to be seen by other people.

Fundamental research, fighting poverty, uncongested toll roads now, uncongested non-toll roads. Now, these are all goods that are neither excludable nor rivals in consumption. In the case of un-

congested non-toll roads because there is no toll so, there is no restriction so, it is not excludable and because it is uncongested so, there are less number of vehicles that are applying and so, if a few more vehicles get inside, it is not going to reduce the quality. So, these kinds of goods are known as public goods.

Now, in the case of public goods, we have the free rider problem. Free rider is a person who receives the benefit of the good but avoids paying for it. So, this is a person who receives the benefit. Why does he receive the benefit? Because this public good is non-excludable, but in this case, he avoids paying for it. So, he is getting the benefits without paying the cost. So, he is a free rider, and a good example is this example of Ram who is not paying for the beautification of his society but is gaining all the benefits of it.

Now, there are a number of solutions to the free rider problem. One is public sector provisioning of public goods. So, in this solution, what happens is that the public sector or the government provides the public goods. So, when we talk about things such as national defense, then it is the government's rule to provide for this good. When we talk about uncongested non-toll roads, roads that are joining the villages that are in very distant areas, they are provided for by the government and the government gets money through taxation. So, in this way, this problem can be solved to quite an extent.

Or social norms sanctions, in this case, if we have a resource such as a warning siren. Now, in this case, the social norms and the sanctions may say that everybody should pay for the warning sirens to be installed and if a person does not pay for the; for the warning sirens, then probably this person will be ostracized. So, social norms and sanctions can help solve the free rider problem.

Also, if they find a person who is doing uh free riding, then there can also be a social boycott. So, in this way, the social norms and sanctions can be used, or the use of voluntary organizations such as the Red Cross. Now, this is similar to the government providing these services or we can have contracts or we can have a private sector that is providing the goods at a cost such as lighthouses charging nearby ports.

Now, in this case, what happened was that the lighthouses used to provide direction and used to give a signal to the boats or the ships that there is a port nearby. Now, if there was a ship that was not paying for the running of the lighthouses, then in that case, the ship cannot be excluded from seeing the light and also this uh, but is non-rival in consumption. But then, if this happens, if nobody wants to pay for the running of the lighthouses, then there will be no lighthouses.

In this case, the solution was that the lighthouses started to charge the nearby port. So, they used to say that ok, if ships come to your port, then in that case, there will be business going on in that port. If you do not pay us, we are going to switch the lighthouse off. Once that happens, the ships will not know that there is a port here and they will just bypass your port and they will go to another port.

And in this way, the private sector so, in this case, the lighthouses were being built and run by the private sector, but the private sector started charging and they used to charge in such a manner that they used to get the fund or integration of the potential free riders. A builder who is constructing a complete colony will not worry about free riders using these street lights since all the

land where the land where the light is falling is his.
So, streetlights are also public goods because you cannot exclude people from using them and they are non-rival in consumption, but if nobody pays for the streetlights, then what will happen? There will be no streetlights.
So, either the government can provide for the streetlights or the builder can provide for the streetlights and when the builder provides for the streetlights, then there is no issue of free riders because the land that is being lighted also belongs to the builder. So, in this case, the integration of potential free riders can solve the problem.
In certain situations, the free rider problem is very easily solved through private provisioning such as when some individuals care more than others because of their higher income or stronger taste for public goods. So, a rich person may pay for getting his surroundings clean, irrespective of whether poor people in the surroundings pay for it or not.
In this case, the public good will be made available by the rich person for the use of everybody because he cares so much about his clean surroundings that he does not care about whether others are paying for it or not. This is one case. Another is the case of altruistic activities. When individuals value the benefits and cost to others in making their consumption choices.
Example is when people trust others. If there is a person who trusts everyone or if there is a society where everybody trusts everybody so, in that case, the free rider problem will not be there because of the trust, because of an ingrained social value, the free rider problem will get solved by itself.
Or the warm glow model, a model of the public goods provision in which individuals care both about the total amount of the public good and their particular contributions such as getting publicity by doing social work. Now, in this case, the public good is being made available through social work because people feel good about doing the social work. So, these are three cases where the private provisioning or free rider problem can be done.
Now, there is one issue when we say that the public sector can provision for the; for the public goods, one is that they can be crowding over which means that as the government provides more of a public good, the private sector will provide less, and this will lead to a contraction of the private sector. Now, if you want a free-market economy, if we want a capitalist sort of a system, in that case, crowding out will become a serious problem.
But then, the solution is to contract out. An approach by which the government retains the responsibility for providing a good or service but hires private sector firms to actually provide the good or the service such as government hiring private firms for cleaning of localities and paying them through the tax revenues.
In this case, the private sector will be working because they are actually doing the cleaning operation, but because the government is acting as an intermediary by paying them through the tax revenues so, in this case, the free rider problem gets solved automatically because the government ensures that these private sector firms get money for doing the work. So, this is an option.
In summary, we have these four kinds of goods determined by whether they are excludable or not and whether they are rivals in consumption or not.
That is all for today. Thank you for your attention. Jai Hind!

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Module 8
Public sector and Conservation
Lecture 3
The design of the tax system

Namaste! We carry forward our discussion on Public Sector and Conservation and in this lecture, we shall have a look at The Design of the Tax System. Now, we know that governments spend money on conservation or things like environmental protection and in certain cases, the total amount of spending is pretty substantial. So, countries in the European Union spend like 1.2 to 1.4%, in some cases less, in some cases more of their GDP, a percentage of their GDP into environmental conservation.

If the GDP is large, the total offset for conservation also becomes large. Similarly, when we look at the sustainable development goals, then the world spends to achieve those sustainable development goals. In our country, this news article says the environment ministry gets rupees 3100 crores in 2020-21 of which 460 crores were allotted to control pollution. Now, the thing is 3100 crores is not a small amount. The question is where is the government going to get this money from?

Similarly, this article says in the Karnataka budget, we have a survey of the shola forest to conserve diversity and we have observed in one of the earlier lectures that the shola forest are a very unique ecosystem in which we have grasses and we also have the trees and they are in a dynamic equilibrium. Now, because these are very unique ecosystems, they have certain specific requirements and the governments are paying key to those requirements. But then, where is the money going to come from or this one?

As the government plans to use 75 percent of MGNREGS Work to Conserve Water. So, what the government is doing is that it is using this scheme of MGNRDEGS for water conservation, which means that a particular portion of the budget is being used for conservation purposes.

In this case form is the conservation of water. Government sanctions 305 projects for clean Ganga Mission. Here again, we are spending money on the cleaning of the Ganges river. Clean Ganga mission gets a boost. Varanasi sewage plant to clean 14 crore litres of wastewater every day.

In this case, the government is using money to set up a sewage plant and the sewage plant is going to perform water treatment. Now, this is important for conservation. But here again, all these things require money. Forest department to set up the world's first mangrove zoo at Jharkhali, all of these requirements. And this money comes primarily from taxes, which is why a study of

taxes is very important for the study of or for the implementation of conservation.
Because we are getting money for all these conservation activities, primarily from taxes. So, it becomes important to know what taxes; what are the pros and cons of the tax; how should the government decide how much amount of tax to impose on people; who is going to pay the taxes; are the rich people going to pay the taxes or are the poor people going to pay the taxes or are we going to have a system in which everybody pays the same amount of tax; how do we decide between these things.
Because these are important, they have important ramifications for conservation. So, we need to understand them in the context of conservation economic system and the most important point about taxes is that taxes have deadweight losses. So, to review what we saw earlier was that when the government imposes a tax only on the sellers. So, in that case, the government can say that whenever there is a sale of a good, then the seller will have to pay such and such amount on every sale to the government as taxes. Now, when that happens, the cost to the sellers to sell the good increases, which is shown by this left shift. So, the supply curve is shifting to the left and the amount of the shift is given by the amount of the tax. So, more the tax, more is the shift.
Now, even though the government is imposing this tax only on the sellers, what we are observing is that this tax is getting distributed between the buyers and the sellers which means that earlier, we were having this equilibrium. So, this was the natural demand and supply equilibrium which was giving us the price without the tax and it was giving us the equilibrium quantity that was demanded or supplied by the market. Now, the supply curve shifts to the left because of the tax.
This is the new equilibrium. This is the price that buyers have to pay to get the goods and because of this left shift, we also observe that there is a reduction in the quantity that is demanded or supplied. So, essentially what is happening in this case is that the market has shrunk. The market has reduced in size because now, there are lesser goods that are demanded and supplied in the market; now, that is going to have an impact on the society.
So, even though the government is taking this money from the sellers, one of the reasons to have this money is also conservation. So, the government is taking this money from the people, in this case only the sellers for the conservation purposes; but this is leading to a shrinkage in the market and the price that the sellers get can be figured out by drawing a vertical from the equilibrium with the tax, it cuts the supply curve here. So, this is the cost of making the goods and supplying the goods by the sellers.
This is the price that the sellers pay. And even though the tax was imposed only on the seller, this tax gets divided. This is the seller's sphere, which is the price without the tax that they were getting minus the price that they are getting when the tax has been imposed.
This is the seller's share and we also have a buyer's share which is the price that the buyers are paying now minus the price that they were paying without the tax. So, in short, what is happening here is that even though a tax has been imposed only on the sellers, we are observing that it gets distributed between the buyers and the sellers and the market shrinks. There are now lesser quantities of goods that are demanded and supplied in the market.
A very similar thing happens when the tax is imposed only on the buyers. Now, when the tax is imposed on the buyers, the demand curve of the buyers shifts to the left. Because now things are

becoming more costly, because people will now have to pay more; because they will not have to pay just the seller, but they will also have to pay the government in the form of the tax. So, in this case, the demand curve is shifted to the left.

The supply curve remains the same and here again, we observed that this is the normal equilibrium, the equilibrium without the tax and this is the new equilibrium. Now, in the equilibrium without the tax, this was the quantity that was demanded or supplied and this was the normal market price.

When the equilibrium shifts, then a lesser quantity is demanded or supplied. So, what we are observing here is that when the tax is imposed only on the buyers, then also the market shrinks; lesser quantity of goods are now demanded and supplied in the market and another thing that happens is that the price that the sellers will get is given by the point, where this new demand curve is cutting the supply curve. Now, the supply curve in this case does not shift.

So, this is the price that the sellers pay. And to get the price that the buyers must pay, we can draw a vertical and this vertical cuts the demand curve at this point and this is the price that the buyers will have to pay. What is happening here is that when the government is putting a tax only on the buyers, then the buyers will have to pay this amount to the sellers and the buyers will have to pay a certain portion to the government so that the total price that they have to pay is much higher.

Now, here as well the tax burden gets distributed because the new price that the buyers have to pay is this, the price they were paying before was this. So, this difference between the enhanced price and the earlier price is the buyers share and similarly, earlier the sellers were getting this much amount, now they are getting this amount.

This difference between the new price that they are getting which is this one and the earlier higher price that they were getting, before the tax, this is the sellers share. So, in short what is happening is that even when we have a tax only on the buyers, here as well the tax gets distributed between the buyers and the sellers and the market shrinks.

We can say that whenever there is a tax, the size of the tax together with the elasticity of the demand and supply curves will determine how much is the buyer's share and how much is the seller's share. So, the size of the tax is less, then both buyers and sellers will have to shell out a lesser amount of money.

If the size of the tax increases, they will have to give more money and whether the buyers have to pay more or the sellers have to pay more is determined by the elasticity of the demands in supply curves. But whatever happens, whenever there is a tax, it would lead to two things; one, it will get distributed between the buyers and the sellers and two, the market will shrink. And this shrinkage also leads to a shrinkage in the surplus.

We have observed before that whenever there is a tax, then the government gets a certain amount as the tax revenue. This tax revenue is determined by the size of the tax which is this much. This is the size of the tax, T and the quantity that is I mean traded in the market that is bought or stored which is Q.

Now, multiplication of Q which is the quantity demanded or supplied with the T or the tax size will give us the tax revenue. Earlier, we were having a situation in which we had a large con-

sumer surplus. It was given by this triangle and a large producer surplus, which was given by this triangle.

But in the new situation, what is happening is that now, we have a reduced amount of consumer surplus which is now given by this triangle. So, earlier, we had a larger consumer surplus, now we have a smaller consumer surplus. The producer surplus also reduces.

This is the new producer surplus that we have. So, it also reduces; a certain amount gets accrued to the government in the form of government revenue and we also have a deadweight loss because of this taxation, which is this gray color triangle. So, earlier, where we were having a large producer and consumer surplus, now the producer and consumer surplus have reduced. The government is getting a certain amount of the surplus in the form of tax revenue; but there is also a deadweight loss.

The government when it is taking money in the form of taxation, the government will have to make certain decisions. Now, we had observed before that economics is the science of making decisions. So, economics helps us answer things like what to produce, how to produce, how much to produce, for whom to produce, when to produce and things like that. Now, similarly, when we are talking about taxation and the government needs taxation for its own work ins.

And it also needs taxation money for conservation purposes and the government is doing conservation for the people. But then, when the government takes money from the people to do conservation for them only, then in this process the government also reduces the total surplus in the market.

The government gets a share of the surplus in the form of tax revenue; but it also creates a deadweight loss. Now, the question for the government is if we are taking these taxes from the people to work for them and in this process, we are also reducing their surplus, which is their welfare; then, how do we decide how much amount of money to take from the people? That becomes an important question. Because any maximization of the tax revenue can only happen by increasing the deadweight losses.

This now is an important question for the government; how do we increase the tax revenue, while keeping the deadweight losses at a low level and we saw that deadweight loss is the fall in the total surplus that results from the market distortions, such as taxation.

What is happening here is that if the government does impose a tax, then it distorts the market. We saw that the earlier quantity demanded or supplied in the market was large and after the imposition of the tax, the market shrinks. So, this is a distortion in the market.

Now, any such distortion in the market is going to reduce the total surplus that is there in the market and this reduction in the total surplus that results from a market distortion such as taxation is known as a deadweight loss. Now, taxes cause deadweight losses because buyers and sellers are prevented from realizing all the gains from the trade. Now, all the gains from the trade would mean this total surplus that was accruing to the buyers and the sellers earlier.

This was the total surplus that was being accrued earlier, but because of this deadweight loss, now there is a reduction in the surplus. Taxes cause this deadweight loss because buyers and sellers are prevented from realizing all the gains from trade and this loss of surplus does not even accrue to the government, since trades that become uneconomical due to the taxes do not occur at

all. So, now the question to the government is how do we maximize our taxes.
While ensuring that the deadweight losses are kept at the minimum. And in this context, we can talk about the Laffer's curve which tells us that when the size of the tax is small, that is T is small; with small T, Q will be large. Now, Q as you will remember is this much, this is Q. So, this much is Q. Now, if T reduces, then Q increases which means that the mode you increase the size of the T which is the tax size as it increases, the market shrinks even further.
The shrinkage of the market is related to the size of the tax. Now, when we have a very small tax that is T is very small, in that case Q is large; but then because T is very small, so Q into T in total is small. So, what that means, is that when T is small, then the total tax revenue which is given by this pink colored rectangle, it is small. Now, a situation of a very low amount of T is not good for the government because in this case, the government will not get a sufficient amount of money in the form of taxes.
Most of the countries do not have a very small value of T; T is pretty substantial because when the T is very small, then the government would think that ok if I increase the amount of T by say a small value, then there will be a shrinkage in the market.
But probably that shrinkage will not be that large, which means that I should be able to increase the amount of my tax revenue without making a very big distortion because T today is very small and when the government has such a thinking, then the government would try to increase the value of T.
When the government increases the value of T, then it would lead to further shrinkage of the market. So, when the government increases the T to a medium level value, then we can observe that the tax revenue, here the tax revenue was very small, now the tax revenue has increased.
When the T increases even further, then probably you can have an even larger amount of tax collection. But then, this cannot go till infinity. Because for a very large value of T, Q will become so small because now the market has shrunk to only this much.
This is now the size of the market; whereas, earlier the size of the market was as large as this. The increase of I mean this larger market, now we have only this much of a market shrink and when the market has reduced to such a large extent, it means that Q is now very small.
Even with a large size T, we will see that Q into T again becomes very small. So, what we are getting from this is that a very small value of T will not provide sufficient money to the government; a very large value of T will also not provide a sufficient amount to the government.
The government should go for a value of T that is in between and this brings us to the Laffer's curve. Now, Laffer's curve is a plot of tax size on the x axis versus tax revenue on the y axis. So, Laffer's curve tells us that as the size of the tax increases, the revenue collected reaches a peak and then starts to decrease and for a very large tax size, we will have a very minuscule amount of tax revenue. So, when we say that economics is the science of decision making.
This Laffer's curve is one indication of up to the government about how to design the tax system. So, a very important consideration that we are getting from Laffer's curve is that the government should have a value of T that is neither very small nor very large, if it has to have a sufficient amount of tax petty.
But the government cannot just work on tax maximization. Now, this is because of the dead-

weight losses and what we had observed was that in the case of a very small T, the deadweight loss is very small. So, this gray colored triangle, this is the deadweight loss. Now, when T is very small which means this height is very small.

Then we have a very small triangle. But when T increases, the deadweight losses.increases. When T increases further, the deadweight loss increases even further and it goes on. So, in this case, we are not observing any maximization of the deadweight loss or any point of minimization; but it is just that as the tax increases, the deadweight losses also increase. But this is an important question for the government. Because earlier when the government was looking at the Laffer's curve.

Then probably this much was the optimum size of the tax. But if we look at this curve at this optimum, the deadweight losses are already too high. So, in this case, with the optimum that is given by the Laffer's curve, the deadweight losses are already too high. So, now, the government will have to think again. The government will say that 'ok, I need this tax revenue to work for the people, but in the process of maximizing the tax revenue, I have already hurted people.

Because I have already reduced their surplus by a very large amount as is given by the deadweight losses. So, this is another consideration that the government should keep in mind, while designing the tax system, that we cannot have a tax system that works only on the maximization of tax revenue.

We will also have to look at what is the amount of acceptable deadweight losses. Now, this term acceptable dead weight losses, it would depend on the country, it would depend on the culture in that country, it would also depend on the level of development in that country and also, on special considerations such as wars. Now, in the time of a war, the government may increase this amount of T probably towards the maximization of the Laffer's curve.

The government will try to maximize the tax revenue to use for war purposes. Because in that case even when the deadweight losses are large, people probably will not mind. But in a normal circumstance, if the government tries to go for a tax maximization. So, people might just revolt against the government. So, this is an important consideration to keep in mind, while designing the tax system. But then, this again is not the only consideration.

We have seen that the taxes reduce the total surplus, introduce deadweight losses and the quantum of the deadweight losses depends on the elasticity of demand and supply. So, essentially if we have a very elastic demand and supply, then in that case the deadweight losses will be even greater and the deadweight losses increase with the tax, but government revenues increase and then decrease as in the case of the Laffer's curve. So, the government has now 2 variables to work on: one is the size of T so that it can maximize the tax revenue, while keeping deadweight losses to an acceptable value; but then, once the government has decided that ok this should be the size of T, the next question is when should the government charge it from and also, if there are any other implications.

Implications such as the administrative burden on people. Taxes increase the administrative burden for people, who are filing their returns. Because in the case of a tax system what the government does is that the government decides that people have to pay this much amount of tax, this is the tax size. But then in a number of cases the government asked the people to do this computa-

tion by themselves. So, a very similar situation to what we have in our country.
At the end of the financial year, what we do is that we make a return of the amount of earnings that we had in the financial year and we compute the amount of taxes that should be given to the government. And that amount of tax should be given to the government. Now, the thing is for a very large majority of people, finding their returns, doing these computations can become a burdensome activity. Because it requires time, time that could in effect have been used for certain other productive purposes.
When the government insists on having a tax even if the size of T is very small, then it would entail people to spend their time in filling out their returns and this time is an unproductive time for a large majority of people. So, one consideration is that taxes increase the administrative burden for people.
One alternative when the government is designing the tax system is a return-free-filing. Now, what is a return-free-filing? In certain countries what happens is that when you do any transaction, so when the one when your employer is paying you a salary, this salary is given in the form of an electronic payment and when the employee is making this transaction, a copy of this transaction gets to the government and the taxes gets deducted at the source.
When you make any payments, say for the education of children or say committing a medical need for which there is an exemption in the tax code, whenever any such payment is made, then that payment is also made electronically and the information automatically gets to the government.
At the end of the year, what happens is that the government just sends a piece of paper probably electronically which gives a record of what sort of money you received and what sorts of payments you made and if those payments get into any of the exemptions, they are automatically exempt from the taxes. There is a computation of the taxes done, a deduction of all different kinds of taxes and then, you get the final value.
You only have to check this document once to ensure that there is nothing that is unacceptable. So, probably there is no deduction that should have been made, but the government failed to make it. But essentially the administration gradually gets reduced to quite an extent.
Because the government has given you all the records that it has about your earnings and about your expenses. The government has done all the calculations and you just have to pay that amount of tax; probably that too electronically. Now, in that case, we call it a return-free-file. So, people do not have to file a return at the end of the year. In most cases, people just pay the amount that is shown on their statement and that amount gets paid and that is the end of the story.
Very similar to what we do in the case of credit cards. So, at the end of the month, the bank sends a statement about what sorts of spending it has observed on the card and how much interest needs to be paid. If everything is fine, you just pay that amount. What if the bank asks you to keep a note of all the transactions that you are doing and then, pay them an interest on that transaction. That would have become an extremely difficult task for most people and similar is the case of taxes.
So, filing of the taxes creates an administrative burden which increases the inefficiency in the so-

ciety because that time, that effort could have been used for certain productive purposes. So, when the government is designing a tax system, one option that is there with the government is return-free-filing that would increase the efficiency of the whole process. Another consideration is complications in the tax code. Now, what is that? The government when it is collecting taxes, it makes a tax code.

The tax code would provide a list of different things that the government is promoting or say not promoting. So, it is possible that the government says that if you provide a donation to a charitable institution, you will get an exemption from the tax. Now, why would the government do that? Because the government wants to promote donations to these charitable organizations. Now, this is a way we have seen in the case of the principles of economics that incentives can make people do certain things.

And so, a deduction from the taxes can be used and is used by the government as an incentive to promote certain activities.. Now, what happens is that over time, the government goes on making additions and subtractions to the tax code and with time, it becomes extremely complicated.

So, you do not know which all activities are going to get an exemption, which all activities will not get an exemption in the current revision of the tax code. So, probably something for which you were getting a deduction last year has been removed from this year's tax code or probably, something that you were not making a deduction on last year has been added. Now, whenever we have such a situation, when people are filing their tax returns, then they have to go through the current provisions that are there in the tax code. It again increases administrative burden; it again increases gratuity; it again increases inefficiency. Because this time that everybody is spending on reading the tax code and finding out how they can save on their taxes could have been spent on say much productive uses. So, this is another consideration, how complex or complicated or simple should the tax code be.

Now, if the government goes for a simplification of the tax code, so in that case, we will have a situation in which the administrative burden will be reduced. People will know very easily that ok, these are say 4 or 5 activities that we can get exemption on and nothing more, nothing less.

But in that case, the government will not have that fine a control over the kinds of activities that it wants to incentivize or disincentivize. Because after all these provisions were only made so that the government could incentivize or disincentivize certain activities. So, if the government goes for a finer control, it would increase complexity;

If the government reduces its control, it would make the tax code simpler. But in that case, it might reduce the spending on those activities that the government was finding necessary for society. Now, what it means is that the government was putting these complications because of the economic principle that governments can sometimes improve upon the market outcomes. So, this is one way of improving the market outcome.

But if the government goes for a simplification, then probably the government will be shifting from its duty to improve the market outcomes in the best possible manner. It will be giving out its power. That is another consideration while designing the taxes. Another is that exceptions in the tax law may permit very low taxes.

What happens in a number of cases is that there are people, who are experts in finding out the ex-

ceptions, finding out the loopholes and in the case of certain people, they may do their spendings or they may do an asset allocation in such a manner that overall, they have to pay a very less tax. While everybody on an average is paying say 20 percent tax, there could be certain people who are paying only 3 or 4 percent of their income as taxes because they are making use of all the loopholes that are there. Now, these loopholes were again put into the tax code because the government was trying to promote certain activities.

But then, if this promotion of certain activities through this incentive of a tax break is extended to such an to such a level that it becomes a loophole, then that would again become counterproductive. So, here again the government has to look at how much is the amount of control, how much is the amount of exceptions that it wants to put in.

Now, exceptions are helpful to a large number of people for 2 things; one it reduces the amount of tax burden that they have to pay and two, by using these exceptions, the government channels their money into those activities that can help the society. Now, if these exceptions are removed, then probably these benefits will also be triggered.

So, this is another consideration. Another consideration is whether to choose for efficiency or for equity. Lump-sum taxes are the most efficient, while progressive taxes are the most equitable. Now, what is a lump-sum tax? A lump-sum tax is a tax that is the same amount for every person, which means that if the government says that from this year onwards, every person will have to pay 1000 rupees as tax. So, that is a lump sum tax.

It has got nothing to do with whether you are rich or whether you are poor or whether you are a soldier or whether you are businessman, it has got nothing to do with anything; whether you are an old person, whether you are a young person, nothing good. It is a lump-sum tax. If you are a citizen of this country, then every year, you will pay 1000 rupees as tax. Now, a lump-sum tax in certain cases is very efficient because everybody knows from the beginning of the year that ok, I will have to pay 1000 rupees as tax.

The rest of the money that they have that can be put into a use that will provide them the largest amount of returns. It simplifies everything; it simplifies the administrative burden and regally because everybody knows that they just have to pay 1000 rupees and the rest of the money will probably be used for such productive purposes as good help the society as well because it would be increasing the surplus in the society. But then, if we go for a lump-sum tax.

Then there will be there will be certain people who would say that ok in this tax code, a poor person is being forced to pay the same amount as is a rich person or probably, somebody would say that a person who is very old, he or she also has to pay the tax at the same rate as a young person is paying; whereas, the old people have a large amount of medical requirements, they cannot work that hard. So, this is a tax that is discriminatory.

It is putting a negative burden on the old people; it is putting a negative burden on the poor people. So, now, this again becomes a consideration. The lump-sum tax was good because it was reducing the treasury of everybody; but then, in the process of reducing the treasury of everybody, it might increase the amount of tax that needs to be paid by a certain specific set of people, who probably need more help from the government. So, that is because they are in a lesser position to pay the taxes. So, this is a lump-sum tax.

So, a lump-sum tax is the most efficient. Another kind of tax is a progressive tax. Progressive tax is a tax for which higher income taxpayers pay a larger fraction of their income than do low-income taxpayers. In our country, we have a progressive tax system. The more you earn, the more you pay. This is the progressive tax system.

It ensures that poor people who have less earnings will also have to pay less taxes; old people who are not working because of their old age or because of certain health conditions or because they have retired. So, those people also will have to pay less taxes. That is a progressive tax.

Now, a progressive tax is very equitable because it shares the burden in such a manner that people do not feel a very large amount of pinch. In the lump-sum tax, the poor people or the old people would be feeling a very great amount of pinch because they have to pay the tax at the same rate as the other people are paying.

But in the case of a progressive tax, it is much more equitable. So, this is another consideration that the government has to keep in mind; whether it wants to go for a lump-sum tax or a progressive tax because here again, we have pros and cons of each of them.

Another consideration is regarding who should pay and here, we have got two principles. The first one is called the benefits principle. The idea that people should pay taxes based on the benefits they receive from government services. What we are saying in the case of benefits principle is that the benefits principle says that the taxes that you pay is just a form of spending that you do for getting certain services. So, the government provides services such as protection.

Now, a person who is rich, probably has a large amount of assets. So, this person would require a greater amount of police protection than say a person who does not have a very large amount of assets. Because if there is a theft, then probably a thief would want to perform theft in the house of a rich person.

So, because of the presence of the police, the rich person is benefited more than the poor person. Now, if the rich person is getting more of the services in the form of the police services, protection services; then, the rich person should also pay a greater amount of share in the form of taxes. So, this is what the benefits principle says. The idea that people should pay taxes based on the benefits that they receive from the government services.

Rich need more police protection, so they should pay more for the police protection. Roads should be built and maintained by taxes on petrol and diesel because the people who are using the vehicles, the people who are using petrol and diesel, they are the people who are going to be using the roads.

So, they should be paying for the building and for the maintenance for the upkeep of the roads. Now, this is the benefits principle and it changes the work of the government to that of a private provider of services. So, probably, if we shifted to a benefits principle, then there could be say a private person who provides protection services. So, this person employs a number of security guards and he or she provides protection services - security services to rich households.

Now, in that case, the benefits principle would say that ok now these rich people do not need police protection because they have had a private security service. In this case, now they should be repaying less for the less in the form of taxes. Similarly, when we talk about the roads and their building and upkeep being done by taxes on petrol and diesel, then probably there could be a pri-

vate contractor who builds his own roads.
And in that case, he is going to charge the people for these roads. Now people should have the option whether to pay the government or whether to pay the private contractor. Now, this is what the benefits principle would say. But what about those services that everybody is using, things such as clean air, clean water that are all the benefits of conservation. If you get a thrill of seeing a tiger, then that thrill is something that you will only get when the tigers are there.
Now, probably you can say that no I want to save my money and so, I am not going to go see a tiger. So, why should I pay for the conservation of tigers? But then, if everybody starts to think like that, then probably in a short period of time without any protection; all the tigers get post upon and once that happens, it is possible that your next generation or their next generation that is your children and grandchildren, they want to see a tiger; but then there is no longer any tiger left.
So, the benefits principle, it may help in certain cases, but in a large number of cases and especially for questions of conservation benefits principle might not apply. Because how are you going to charge everybody for safe clean air; how do you figure out who is using how much of the clean air and how much of dirty air or who is using how much benefit of biodiversity and who is using less amount of biodiversity. So, these are questions that are extremely complicated to answer.
So, the benefits principle might be used in certain cases in a tax system; but for a large number of cases, it just does not apply. Another principle is the ability to pay principle, it is the idea that taxes should be labeled on a person according to how well that person can shoulder the burden.
That is, does the person have the ability to pay and the greater is the ability of a person to pay, the more should be the tax. Which means that there should be an equitable taxation system. An equitable tax system can be described in terms of the vertical equity and the horizontal equity. Vertical equity is "the idea that taxpayers with a greater ability to pay taxes should pay the larger amounts", which can take the form of proportional tax, regressive tax or progressive tax.
In the case of vertical equity, we are saying that people who have a larger ability to pay taxes should be paying the more taxes and people with a lesser ability to pay taxes should be paying lesser amounts of taxes. Now, this can take the form of a proportional tax. Proportional tax is a tax for which high income and low income taxpayers pay the same fraction of income, which means that if we have a tax system that is a proportional tax system, then in the tax code.
We will say that ok everybody has to pay a 5 percent tax or say a 10 percent tax. Now, in the case of a 10 percent tax, a rich person will also be paying 10 percent of his or her income in the form of taxes and a poor person will also be paying only 10 percent of his or her income in the form of taxes.
In this case, the taxation is proportional. Because everybody has to pay the same proportion of their income in the form of taxes; but then, it is an equitable system because the rich person who is earning more will also be paying more because that 10 percent is now a very large amount.
What we are saying here is that a person who is earning say rupees 10 crores will be paying 10 percent which is equal to rupees 1 crore and a person who is earning rupees 10 thousand, here again this person will only be paying 10 percent. And in this case, the 10 percent is rupees 1000.

This is an equitable tax because we are asking both the rich and the poor to pay only 10 percent. But by asking them to pay 10 percent, we are taking a larger sum from those people with a greater ability to pay and we are taking a smaller amount from those people who have a lesser ability to pay.

So, even though, in this case the taxation is proportional to the income, it is having a vertical equity because we are taking a larger amount from people with a greater ability to pay and a smaller amount from people with a lesser ability to pay. So, this is a proportional tax. Another tax is a regressive tax, a tax for which high-income taxpayers pay a smaller fraction of their income than do low-income taxpayers because when the income is more, there is in total more tax even when the fraction is small.

In the case of a regressive tax, what we are saying is that the poor people will have to pay 10 percent, but the rich person will have to pay only 1 percent. Now, in the case of the rich person, this 1 percent is 10 lakhs of rupees; rupees 10 lakhs. Now, this regressive system would say that this is still an equitable system because the person with a greater ability to pay, a person who is earning 10 crores of rupees is still paying a very large amount.

He is paying 10 lakhs of rupees and a person with a lesser ability to pay, who is earning 10 thousand rupees is paying 1000 rupees. Here again, we are taking a larger amount from those people with a greater ability to pay and a smaller amount from those people with a lesser ability to pay. People would say that yes, this again is an equitable system because you are taking a larger amount from people who have a larger capacity to pay.

But then, this is a regressive tax system because the richer a person is, the smaller fraction of his or her income needs to be paid as taxes. So, which is why we say that this is a regressive; the higher you go in the income ladder, the lesser proportion of your income you have to pay as taxes. But here again, it is an equitable tax. And the third tax is known as progressive tax, a tax for which higher-income taxpayers pay a larger fraction of their income than do lower-income taxpayers.

What we are saying here is that in the case of these people, who are earning 10 crores; now in the case of a progressive tax, we are saying that the higher one goes in the income ladder, the more is the taxation. Which means that the poor person will have to pay 1 percent and the richer person will have to pay 10 percent. So, 10 percent of 10 crores is 1 crore and 1 percent of 10 thousand is 100 rupees. Now, in this case this again is an equitable tax.

It has vertical liquidity because a person with a lesser cap capacity to pay is paying a lesser amount and a person with a greater ability to pay is paying a larger amount. So, here again, it is equitable; but it is progressive because the more you earn, the larger fraction of your income. That is if you are earning less, you are paying 1 percent; if you are earning more, you are earning a larger amount, a larger fraction 10 percent. So, the more you earn, the greater fraction of your income needs to be paid as taxes.

Now, we can have all these different kinds of vertical equities, these different forms of taxation; proportional, regressive or progressive that can lead to vertical equity. But again, which of these is going to be used in a society will depend on that particular society.

Because in the case of a progressive tax, there are certain people who would say that - 'yes pro-

gressive tax is good; it is great because the poor people have to pay a lesser fraction of their income, the rich people have to pay a larger share of their income'.

But somebody else would say that - 'ok, so if I work harder, if I earn more, I will have to pay a larger portion of my income to the government which means that I will be left with an even smaller fraction. So, is the government not disincentivizing people to work'. Because again, people respond to incentives and if you tax the rich people with a greater fraction of their income, are you not disincentivizing them to be rich? So, do you want to convert the country into a bunch of poor people?

No, these are questions that are not just economics questions, these are philosophical questions. So, this is vertical equity. Another equity is horizontal equity. The idea that taxpayers with similar abilities to pay taxes should pay the same amount. Now, in the case of vertical equity, we were saying greater ability to pay taxes and in this case, in the case of horizontal equity, we are saying people with similar abilities to pay taxes should pay the same amount.

When we talk about verticals, we are talking about differences. So, when we say vertical, we are saying that this person needs to pay a different amount from this person. In the case of horizontal equity, we are saying that if 2 people are at the same level, then they should be paying the same amount of money as taxes.

And in this case, we are saying similar ability to pay; but then, the question is what is a similar ability to pay. If there are 2 families and each family is earning 10 lakhs of rupees and one has 2 children, the second has 10 children. Now, should they pay the same tax? Because in the case of a family with just 2 children, they probably have to spend less on having just 2 children. The expenses on food, the expenses on education, the expenses on clothing will be lesser because there are only 2 children.

On the other hand, the second family that is having 10 children will have to spend more on education, more on food, more on clothing, more on everything. So, these are 2 families that are each earning 10 lakhs of rupees; but do they have the same ability to pay or should we say that the family that has 2 children has a greater ability to pay because their expenses are less and the family with 10 children has a lesser ability to pay because they have more children and so more expenses.

But if we make that distinction and if we say that the family with 10 children will have to pay less taxes, are we not incentivizing families to have more children, when we are already suffering from overpopulation. So, that is the question: should they pay the same tax?

And if we allow tax breaks to the second family, are we promoting large family norms? So, this is another consideration that the government needs to keep in mind. Another consideration is should we aim at average taxes or marginal taxes. Now, average tax is total taxes paid divided by the total income.

Which means that if you are earning 100 rupees and you are paying 10 rupees; then, your average tax is 10 percent. Marginal taxes on the other hand is the amount by which taxes increase from an additional unit of income, which means that the marginal tax is asking the question that if I am earning 100 rupees, I am paying 10 rupees; if I earn the next 100, will I have to pay 10 rupees on the next 100 or do I have to pay 20 rupees for earning the next 100?

That is the amount of tax that I need to pay for the additional income that I am making. So, if I earn 101 rupees, how much amount of tax do I need to pay on this 1 rupee? Now, if we say that people who are earning less will have to pay less and the more they are earning, the higher will be the tax bracket; that is if the marginal taxes are high, then are we seeing as a society that people should not work hard, they should not earn more.

This again is a consideration. Should the government aim for average taxes or marginal taxes in the tax scheme? Similarly, should we have a tax on income or a tax on consumption? A tax on income discourages people from saving; whereas, a tax on consumption promotes people to save. Why? Because if there is a tax on consumption, it would mean that the more you spend, the more you will have to pay. So, whatever you are earning, you can keep with yourself; but the more you will spend, the more you will have to pay the tax, which means that the government is saying that everybody should try to save as much as possible. Because the more you save, the less you will have to spend. On the other hand, in the case of an income tax, the more you earn, the more you have to pay the taxes.

So, a tax on spending will promote people to have the habit of saving. So, that will increase the amount of savings that we will have as a nation in total; but here again, the question is can we shift from an income tax to the consumption tax because it may be complicated or should we just say that because for so many years, we have been having income tax. So, let us just stay with the income tax. So, these are all different kinds of questions.

And a large number of these questions are not just questions of economics, but also philosophical questions. Because you need to make a choice between efficiency and equity. And as we saw before, economics is the science of decision making; economics is the science of choosing between options.

You cannot have all of everything, you will have to choose between a lot of things; you can choose between efficiency or you can choose to have more equity. This is a choice that needs to be made and which makes the design of the tax system at times complicated.

That is all for today. Thank you for your attention. Jai Hind!