Conservation Economics
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Module 5
How can Economics help?
Lecture 1
Need to understand controls

Namaste!
So, far we have looked at why we need conservation, what are the threats to widening. Now, the question is how can we use the knowledge of economics for the aid of conservation? Now in this module, we will look at how economics can help in achieving our objectives of conservation. And this module will have 3 lectures, the first one is the Need to Understand Controls, second is thinking as an economist, and the third is interdependence and gains from trade.
Let us begin with the need to understand the controls. And we begin with a thought experiment. Consider that there is a 747 aircraft and in this aircraft there are two pilots and these two pilots are in disagreement. The question is this plane facing an imminent danger, can this plane go and crash, is there something that is going wrong.
Now, both of these pilots are extremely experienced pilots, but they are looking at different controls and they are looking at these controls correctly. They are reading these controls very correctly. So, both pilots are correctly reading the instrument dials. The pilot 1 is only looking at the altimeter, the on-board radar, and the position of the wing flaps. And the pilot 2 only looks at the fuel gauge, the air speed indicator, and the cabin pressure dial.
Now, the question is it ok to see only certain readings and ignore the rest? Because, if both these pilots do not come to an agreement and they cannot come to an agreement till they talk or they look at each other's readings. Now, if they do not come to an agreement it is possible that both of them will spend their time in disagreement and the plane might go and crash. For instance pilot 2 is looking at the fuel gauge, but pilot 1 is not looking at the fuel gauge.
Pilot 2 looks at the fuel gauge, but pilot 1 does not look at the fuel gauge. For suppose the fuel gauge shows that the amount of fuel in the aircraft is extremely low because of which the plane might not work so, it is possible that this plane that is flying the engines will stop and it will crash. Now, pilot 2 is seeing this gauge and he is currently correctly reading that this plane is an imminent danger of crashing.
But pilot 1 has turned his eyes off this gauge, he says that I am not going to look at this gauge whatever happens. Now, what will happen? This thought experiment tells us that whenever we are working for a common good we need to be on the same page and we need to look at things in a more coherent manner.

Now, similarly when we talk about economies or when we talk about conservation. Why do we do economics? The aim of economics is to maximize the availability of resources to maximize the benefit of resources to mankind and why do we do conservation? We do conservation for precisely the same purpose. Why do we need plants and animals? We need plants and animals for ourselves.

Because, if we do not have these ecosystems that are working properly then, that will lead to a harm to us as a species of homo sapiens as well. When both of us, the economists and the conservationists, are working towards the same goal, it is extremely crucial that both of them read all the dials together.

Now, currently the situation is that the conservationist concentrates upon the loss of habitats, loss of biodiversity, coral bleaching, soil erosion, pollution, global warming, and all these things and the conservationist says that the world is going towards the dome.

Similar to the second pilot: the second pilot says that oh the fuel has gone, this fuel tank has gone empty, we are out of fuel and so, this plane is going to crash. Similarly, the conservationist is looking at all these different aspects, he is looking at the biodiversity and he sees that biodiversity is declining at a very fast pace and so, he says oh the earth is going towards the doom.

But then, we have the economist who concentrates upon increasing GDP, increasing per capita wealth, and resource efficiency. And the economy says oh all over the world the GDP is rising, the per capita GDP is rising, we are using resources with exceedingly greater efficiency. So, there is no cause for concern, because we are doing everything in a much better manner than we were doing previously. Why is there a cause of concern? There is nothing wrong.

Similar to the first pilot who was ignoring the readings of the fuel tank, and was saying that this plane is flying ok. Now, the question is it ok to see only certain readings and ignore the rest? Because if that happens, if we do not take all the readings into account, it is possible that the plane may crash or the earth will doom.

So, we need to get the full picture to make an informed decision. Now, here it is also important to highlight the differences between the economic thought process and the ecological thought process, as we have seen recently. Now, this is something that needs to be changed. Currently, the economists and the ecologists are having a different thought process. They are looking at different dials and they are coming to different conclusions.

We need to bring both of them to the same page but before bringing them to the same page it is important to realize what are the differences between both of these. The first one is the time horizon. The economist looks at a much smaller time horizon than the ecologist. The time horizon in the case of economics is say the next year, the next decade or probably the next century, but not beyond that. Whereas, when the ecologist looks at things he looks at things at an ecological time scale and also at the evolutionary time scale.

The ecologist might say that we should plan for say the next hundreds of years, or probably we should plan for the next millions of years because a number of these processes in ecology they happen at such a slow pace that whatever harm we do to the environment will come to the results or we will face the consequences after a time being.

The ecologist says that whenever we are setting up any new industry, the ecologist would say oh

hang on. First let us see, if we can carry on with this level of pollution, why do not you go and install say a catalytic converter to reduce the amount of smoke that is coming down.

Now, the economist would say oh if I install this machine or if I install this equipment probably I will be able to recuperate the cost in say the next 30 years. So, this is not good from an economic point of view but the ecologist might say that no this is extremely crucial otherwise; we might have a situation of acid rain. Now, this time horizon needs to be kept in mind.

Secondly, the differences between sustainability and utility. Now, sustainable development means a development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. So, when we talk about sustainability we are keeping a long term time horizon.

Sustainability says that we need to meet the requirements of this generation while ensuring that the next generations and the generations after that will also be in a position to meet their own requirements, so we are taking a long time span. Whereas, in the case of utility, utility is a measure of happiness or satisfaction. And this measure of happiness or satisfaction is used for current status, for the current population, we do not calculate utility for the next generation, we calculate the utility for us.

Now, in the case of economics we are more concentrated with the current generation. So, we concentrate on utility. In the case of ecological thought processes, we look at sustainable development. We look at in the case of sustainable development as well. We are emphasizing that we need to meet the requirements of the present generation but then sustainable development says that ok we should meet the requirements of this generation, but we also need to ensure that the next generation is also not harmed, in the longer time span.

This is again another difference between the ecological and the economic thought process at present. Now, the concept of utility has brought us to a thought process that is known as utilitarianism. Now, utilitarianism is "the political philosophy according to which the government should choose policies to maximize the total utility of everyone in the society".

Now, utility as we have seen is the measure of happiness or satisfaction. Now, utilitarianism says that we need to maximize this satisfaction of all the people in the current society. So, it is the political philosophy according to which the government should choose policies to maximize the total utility of everyone in the society.

Now, the important thing to keep in mind in the case of utilitarianism or its definition is that nowhere it says that we need to maximize the utility for the current society as well as of the future generations, it does not say that. Just says that we need to maximize utility, and such a thought process in which we want to maximize the utility of the current society can at times run counter to the thought of sustainability.

This is a major difference between the ecological and the economic thought process. Another difference is whether we are ok with externalities or whether we need to internalize the externalities. Now, externalities are the impacts of one person's actions on the well being of a bystander. "The impact of the actions of one person on the well being of a bystander" and it and there are two kinds of externalities, a negative externality and a positive externality.

Now, negative externality means that the actions of one person create a negative impact on the

well being of the bystander. Then, we call it a negative externality such as exhaust from industries, or exhaust from automobiles. Now, the industrialist who set up the industry is getting all the benefits from the profits that the industry is bringing. But the pollution that is caused by the industry is causing harm to the society as a whole. It could even be at the global level in the case of certain chemicals that are being released.

Now, the negative consequences are faced by everyone in the society, the positive consequences are retained by the industrialists. This is an example of a negative externality because, the industrialist when he or she is taking this decision on whether or not I should set up this industry and what sort of pollution containing measures should I be putting up. Then, he only takes these decisions on the basis of maximizing his or her own utility, maximizing his or her own profits.

And these could even be at the cost of the local surroundings. Because the local surroundings will suffer because of the pollution it is not just the industrialist himself or herself alone who will suffer. So, this is an example of a negative externality. Positive externality is when the action of one person has a positive impact on the well being of others or on the well being of a bystander, good examples are education.

If you educate yourself, if you make yourself a more learned person, then the decisions that you would make in your lifetime are going to help not just yourself, but also your society and also your country and also the world. So, by educating yourself you are not only bringing a positive impact on yourself, but you are also bringing a positive impact on everybody else.

Similarly, if you keep yourself healthy, if you vaccinate yourself, you play a role in stopping the movement of diseases or stopping the spread of diseases. So, vaccination or health or exercising daily these are all actions that have a positive impact on the well being of others, or on the well being of the society or the country as a whole. So, these are positive externalities.

Now, the economic thought process states that we mostly concentrate on the well being of ourselves. Because, economics as we have seen before, economics considers that everybody is a rational person. Now, rationally if I am an industrialist I am setting up an industry and whether or not I should put up equipment to contain pollution is the question before me.

Now, rationally if I do not suffer from the consequences, there is nobody to force me to install this equipment and if I install the equipment my profits will go down, because there is an investment that is involved not only in the installation of the equipment, but also in its running cost. So, rationally I might take the decision that I should not install the pollution containing device because I am taking this decision rationally.

This is the economic thought process. The ecological thought process would say not all the externalities get internalized. In that case, what is the decision that a rational person should make is the correct decision, which means that an ecologist might say that ok, if such and such amount of pollution is released, and it causes so and so amount of health impacts on the surrounding people and if all of those people were to go to a hospital for their treatment.

What is the total cost of that treatment that everybody would have to pay? If you sum that up and if the industrialist were to pay that cost because it is the action of the industrialist that has brought harm to those people. So, the industry should pay for the cost, the polluter pays principle. Now, if that were the situation, then what is the decision that a rational industrialist would

make, is the correct decision.

In other words, what we are saying here is that suppose the cost of installing the pollution controlling device is rupees 10 lakhs and the cost of health care of people in the vicinity, if the device is not installed is say 30 lakhs, and if the industrialist had to pay this cost. So, in that case if the industrialist does not pay the cost of treatment, then he would have to pay rupees 0.

But, if the industrialist has to pay the cost of treatment then, we would have to pay rupees 30 lakhs. Now, if this is the situation before the industrialist and the industrialist has got two options. Option one is that he or she should get the pollution controlling device installed in which case, the cost to the industrialist would be 10 lakh rupees.

The second option is that ok, you do not want to install this pollution containing device, fine go ahead, but any harm that you do to the surroundings you will have to pay for that. That is you will have to pay for the health treatments for all the people in the surroundings that you have harmed because you have not installed this pollution containing device and that cost is 30 lakhs. Now, what would a rational industrialist prefer, would he prefer paying 10 lakhs or would you prefer paying 30 lakhs?

The answer is very simple, he would prefer paying 10 lakh rupees only and he would install this machine or this equipment into this factory. But, this is only possible when the externalities get internalized, when we have a mechanism to force the industrialist to pay the cost of treatment. If we do not have such a mechanism, if we do not have a way of internalizing the externality, the options before the industrialist are very different.

He has the option of not installing the pollution controlling device which is 0 rupees and the cost of installing the pollution controlling device which is 10 lakhs of rupees. If the externalities are not internalized the two options are whether to pay 0 rupees or whether to pay 10 lakhs of rupees. And of course, a rational industrialist would prefer not to pay any amount, he would prefer to pay 0 rupees and he would not install the pollution controlling device.

So, internalizing the externalities is a very powerful concept to help people make the right decisions. Now, the ecological thought process emphasizes that all the externalities need to be internalized before we take a decision on the correct course of action. Here again remember that the decision is a rational decision, but it says that before taking any decision let us first internalize all the externalities.

This is a major thought difference between the ecological thought process and the economic thought process. Now, what are the mechanisms or what are the methods of internalizing these externalities? Now, the first option is a command and control policy, in which case the government has a big role. So, in the command and control policy such as regulation the government would say ok.

No matter what happens, we are only going to permit an industry to be set up, if the industrialist gets this pollution controlling device installed otherwise, there is no permission at all. So, you cannot set up an industry till you agree to install the pollution controlling device.

This is one way of internalizing externality. Or another way of regulation is that if anything goes wrong the polluter will have to pay, the industrialist would have to pay and we will make use of the government machinery, we will make use of the law and order machinery to ensure that if the

surrounding people are harmed then the industrialists would have to pay. That is another way of regulating things.

In a command and control economy or in a command and control government this is one way of ensuring that the externalities get internalized. But not just the government's role we also have certain market based policies, market based policies include things like Pigouvian taxes and subsidies.

Now, in the case of Pigouvian taxes and subsidies, the government says that we are going to impose a tax or we are going to provide a subsidy not because we want to increase our resources through taxation and not because we want to support a particular person through subsidizing, but we are going to use it to ensure or to incentivize people to do something or to refrain from doing something.

Now, in that case it will be called a Pigouvian taxation or a subsidy. Now, how would a Pigouvian taxation or subsidy work in this case? The government might say that ok the cost of installing this pollution controlling device is 10 lakhs of rupees and we are going to subsidize 9 lakhs of it. So, if any person has to install this machine, he or she only has to pay 1 lakh of rupees.

Now, in this way the government is turning the table, the government is saying that you do not have to now make a choice between paying 0 rupees and paying 10 lakhs of rupees, you have you only have to make a choice between paying 0 rupees and paying 1 lakh of rupees, and paying 1 lakh it should be an easy matter for an industrialist.

The government might in some cases even bring the subsidies to a level that it becomes 0, or the government might even say that ok, if somebody installs this device we are going to pay that person 11 lakhs. So, in that case the government is paying 1 lakh of rupees to incentivize the person and also covering up all the costs of installing this device. Now, this is an example of a Pigouvian subsidy.

An example of a Pigouvian taxation or would be say if anything go if there is a person who is not installing this pollution controlling device, then there would be a higher level of taxation to ensure that the government has sufficient funds to cover up if there is something, if there is a negative impact to the health of the vicinity.

In that case the government would say, ``Ok you do not have to pay, we are going to take care of all the citizens but to take care of the citizens we also require money, we also require taxation. So, if you do, if you make this choice that you are not going to install this pollution controlling device. So, in that case you will have to pay 5 lakhs of rupees as taxes every year.''

And then the industrialist would think that ok, if I install this machine I only have to pay 10 lakhs of rupees, if I do not install this machine I will have to pay 5 lakhs of rupees every year. And so, in a span of like 2 years, I would have already paid the cost of the machine and from the 3rd year onwards, I will be paying more than 10 lakhs of rupees.

Then the choice becomes much simpler. The industries would say ok, if I can get a tax break by installing this machine let me go for the tax break, let me install this machine. So, Pigouvian taxes and subsidies are also a mechanism through which we can ensure that the externalities get internalized and people take those decisions in which others are not harmed.

Another example is a tradable pollution permit. In the case of tradable pollution permits, the government might say that every industry can release only 100 units of noxious fumes or pollutants. And if any industry releases more than 100 units, then the industry will be completely shut down. Or you have another option, the government might say that in place of say polluting 100 units, you are only polluting say 20 units.

In that case you have 80 units left with you and you can sell these units to some other industry, who is unable to reduce their levels of pollution. So, what we are saying here is that you have an industry that has a quota of 100 units; and if the industry only uses 20 units of quota, then they can sell off 80 units.

Now, who is going to buy these 80 units, there are certain industries for which it is easier to bring down the levels of pollution. Such as our industry in question in which we have a device that is available to reduce the levels of pollution. On the other hand, there could be certain industries that have such processes in which it is very difficult to reduce pollution.

Now, the aim of the government here is to ensure that the total level of pollution is down and it does not cross a threshold. So, in the case of these tradable pollution permits, what would happen is that our industrialist might think that ok, if I install this device I will have to pay 10 lakhs of rupees. But by installing this device, I will be able to save so much on my quota; and I can sell off this quota to my neighbor who is unable to install such a machine and he is going to pay me say 5 lakhs of rupees every year.

And if such a situation arises, then in 2 years I will be able to recuperate the cost of installing this device and from the third year onwards I will be earning a profit on it. Now, in such a scenario the industries would go for installing this device. Now, the benefit to the industrialist in this case is that he or she is able to earn the profit. The benefit to the society is that the level of pollution has been contained and the benefit to the other industry is that it is able to pollute more than 100 units by purchasing this from somewhere else.

So, the total level of pollution is already down, but this has brought in a market mechanism through which one industry can sell off part of its quota to someone else. And a big benefit in such scenarios to the society is that those industries for which it is easier and it is cheaper to reduce the levels of pollution become the first ones to reduce the level of pollution.

So, essentially the society is able to reduce the pollution at a lower cost. So, this is another mechanism that is available to internalize the externalities. Then, we also have certain private solutions; private solutions include things like social norms and mores. Now, in the case of social norms and mores, there could be a social norm in a society that we should not give respect to those people who are polluting the environment.

In that case, the level of pollution is brought down by social action. So, people might boycott those industrialists who are doing a lot of pollution and people might start to honor those industrialists who have taken exemplary steps to reduce the levels of pollution. So, through social norms and mores also we can internalize, we can bring in a mechanism to internalize the externalities.

Other examples are charities to social causes. So, there could be say an NGO, who is able to procure these pollution controlling devices and this NGO goes and fits this device to through to dif-

ferent industries say free of cost, but then how does this NGO get money to run this operation, through donations.

Now, in this case the private solution is charity to this NGO. So, the people who are there in the vicinity, they might pay to this NGO as a charity. So, the total level of pollution that they have to tolerate goes down. So, through charities and through NGOs and other social causes as well there is a mechanism to internalize the externalities and bring these negative consequences down.

This is another economic way, in which somebody pays so that the level of pollution goes down. Another private solution is integrating different businesses and this normally occurs in the case of positive externalities. Integrating different businesses it means that, if somebody has an apple orchard and some and this person also starts an apiary to raise honey bees.

Now, in such a scenario what happens is that the person is able to produce honey and sell off the honey and at the same time this person also has the honey bees to pollinate his apple orchard. So, because both of these businesses help each other aid each other. So then, it also makes economic sense to integrate both of these businesses together.

This is also another way, in which internal in which externalities are internalized and especially the positive externalities. Another private solution is through bargaining and contracts such as the Coase theorem. Now in the case of bargaining it is possible that the residents of this area, who are there in the surroundings, might come to the industrialist and they might try to bargain. They might say that ok, you are releasing so much pollutants and that is harming us.

Why do not we come up with an arrangement that can suit you as well as it can suit us because, remember if there is no way in which the residents can force the government to take an action, then the residents might take this action by themselves. So, in this case the industrialist wants to reduce the cost of installing this device and the residents want to save their health.

Essentially the industry does not want to put in 10 lakhs of rupees but if the industrialist does not put in 10 lakhs of rupees, the residents would have to pay 30 lakhs of rupees for their own health. So, the residents might say ok why do not we do this thing, why do not we procure this machine and we install it into your industry.

In that case, the residents are benefited because in place of paying 30 lakhs of rupees, they will only have to pay 10 lakhs of rupees. And the industrialist is also happy because he does not have to pay; or in certain situations and something other than then this can also occur.

It is also possible that the industrialist might say that ok I it is not possible for me to install this device, but why do not I pay you something. So, I will pay you. I will compensate you for the health damages that you have and if the industrialist can come up with a figure that is less than 10 lakhs of rupees, that is also an arrangement between the society and the industrialist.

These are different options that are available for internalization of the externalities. Now, we will look at the Coase theorem in more detail here. So, Coase theorem says that "if private parties can bargain without cost over the allocation of resources, they can solve the problem of externalities on their own".

It only talks about the private party. So, there is hardly any role of the government here. If private parties can bargain without cost, that is it should not cost both these parties to come together in terms of time or in terms of money, that is the transaction costs are reduced. If the private par-

ties can bargain without cost over the allocation of resources, they can solve the problem of externalities on their own.

Now, let us look at one example of this Coase theorem, that we normally see in the case of the tiger reserves. Now, in tiger reserves there are only a set number of vehicles that can get inside on any particular day. Why? Because the national tiger conservation authority looks at this matter and tries to ensure that there is no excessive level of pollution in the tiger reserves.

And at the same time, the animals are not excessively disturbed and so it regulates the number of vehicles that can get inside. Now, there might be some players who have a greater interest in getting inside. A common example is that there are certain Gypsy operators or there are certain guides who are so good at their job, that they receive quite a lot of money in terms of gifts or in terms of honorariums from the people who get inside.

That is what normally happens when this Gypsy driver is taking you to the park. He tells you about all different kinds of birds, he tells you about all the stories that are associated with this park and because of that you are so much entertained that you pay him say 100 rupees extra because he not only took you inside the park, but he also entertained you.

In that case, the benefit that this Gypsy owner will get is much greater than the benefit of some other Gypsy owner who is not good at telling these stories or telling you about the birds and animals. So, in the normal course of operation, one Gypsy owner only gets the amount of money that he or she can charge for taking you inside, but the other Gypsy owner is also getting something extra.

Another difference is that there are some gypsies that are so old, that the cost of running them is higher than say a new Gypsy. So, a person who has a new Gypsy will probably be running at a much greater profit than a person who is having an old Gypsy. Now, if it so happens, that a person who does not get a lot of money from getting inside has been chosen to get inside, because of a roaster system and there is another person who thinks that if in place of this person if I were to go I can earn much more.

Now, how can the Coase theorem bring us to a solution that is beneficial to everybody. So, let us look at this, what we are saying here is that there is this Gypsy and if this Gypsy goes inside the profit is 2,000 rupees. If it does not go inside it gets a profit of 0 rupees, because it is not plying inside. And different other Gypsies have different levels of profits, if they go inside.

There are certain gypsies that will earn more than 2,000 rupees and there are certain gypsies that will earn less than 2,000 rupees. So, suppose these are the Gypsies that have been selected as part of the roster system, that is when the NTCA is that 9 gypsies can get inside. So, these are the 9 gypsies that were chosen and this Gypsy was not chosen.

Now, the NTCA is concerned that only 9 gypsies should get inside, the NTCA is not concerned which gypsy should get inside. Now, how can the Coase theorem bring us to a much better solution? Now, suppose this person whose Gypsy was not selected bargains with this person, who if he gets inside will only earn 900 rupees and this person says that ok in place of you getting inside let me go inside and I will pay you.

This person is saying that, I will earn much more profit if I get inside and so in place so it is your turn to get inside, but you give that turn to me. And to compensate you I will pay you some

money, for this jumping right so to speak. Now, how much money will be paid, anything that is between the profit of this Gypsy that is 900 rupees and the profit of this Gypsy that is 2000 rupees.

Let us say that both of these bargain and they agree on 1200 rupees 1200 rupees and so, this Gypsy owner says that ok you pay me 1200 rupees and I will keep my Gypsy outside and you can go in my place. Now, what happens? This person who would have earned 900 rupees, has now earned 1200 rupees and so this person is happy because, in place of earning 900 he is earning 1200. What about this person? Now, if this person did not get inside because, it was not selected in today's roster.

So, he would have earned 0 rupees. But, now that he has earned this, he has paid for these jumping rights and he now has the chance to get inside he will be earning 2000 rupees, now out of these 2000 rupees he will be paying 1200 rupees to do this Gypsy owner. And now, he will be left with 800 rupees.

So, for this Gypsy owner the choice was either 0 rupees or 800 rupees and this Gypsy owner is now earning 800 rupees, so he is also happy. So, this Gypsy owner is happy because he earned 300 rupees more. This Gypsy owner is happy because he earned 800 rupees more. And NTCA, of course is happy because only 9 gypsies got inside and there is no other issue with this.

So, by bargaining themselves, by doing this bargain both of these parties have come up with a solution that is beneficial to both of them. So, this is an example of the Coase theorem and we normally apply the Coase theorem in the case of conservation these days. For example, through payment of ecosystem services and a good example of this is the Catskill watershed.

What is this story? In New York, the water that is supplied comes from these mountains that are known as Catskill Mountains. Now, the city of New York has got two options, option one is which is the default option that most of us use is that whatever water comes to the city has to be treated. So, you set up a water treatment facility and you run this facility and you pay for its installation you pay for its running, and this is the amount of money that you will have to spend to get good quality water.

The second option, that these people thought was that why do not we do something so that the water that comes to the city does not have to be treated at all. So, they started looking at what causes pollution in this water? And they saw that the people in the Catskill Mountains were also doing agriculture and when these people do agriculture they will be using fertilizers, they will be using pesticides, and these chemicals are coming into the water.

So, the people of New York said ok why do not we do one thing, if we set up our water treatment facility and say we have to pay say 1 million dollars. In place of doing or spending this 1 million every year, if we pay say 500000 dollars to the people who live on top there on the Catskill Mountains and we will say we will tell them that, that you guys refrain from using the fertilizers, you guys refrain from using the pesticides.

And of course, if the fertilizers and pesticides are not used then your crop yields will go down and we are going to compensate you for that. So, we are paying you these 500000 dollars, to compensate you for the lower productivity. Now, the farmers might think that ok, if I do not use fertilizers and pesticides my crop yields surely go down, but what is the extent to which they go

down? It is not that we will be able to produce no crops.
We will be able to produce crops, but probably of a lesser quantity. So, if they calculate and they come to this conclusion that ok, if we go for organic agriculture, we will only be earning 300000 dollars in place of say 400000 dollars that we are earning every year. So, there is a loss of 100000 dollars every year, but now these guys are paying us 500000 dollars to go for organic cultivation.
So, what is the harm? In this way the farmers who are out there in the Catskill Mountains are able to earn much more than what they would have earned through traditional agriculture, so they are benefited. And the people of New York they would in place of failing out say 1 million dollars every year, they can make go with 500000 dollars. So, there is a cost cutting, there is a saving for the people of New York as well.
Now, this is an example of the Coase theorem in which there are two parties that are bargaining at their own private levels and they are coming up with a solution that is beneficial to both of them. The farmers are happy, the people of New York are happy. And of course, the water quality because it is now so good that it can be directly used for drinking.
So, it also helps the environment because you do not have to pay a cost of installation, you do not have to release greenhouse gases because you would have required electricity to run your plants. So, it helps the environment as well. It also helps the biodiversity because those fertilizers and pesticides that were polluting the waters are now not there and so the biodiversity also is much better.
Another difference between the economic and the ecological thought process is the kinds of goods that we are concerned with. And we can divide goods and services into four different categories, based on two concepts: whether they are excludable and whether they are rivals in consumption. Now, what does this mean? Excludability means that "the property of a good whereby a person can be prevented from using it".
Now, what does that mean? It means that if I have this pen, I can say that this is my pen and I will not allow you to use this pen. In that case this pen is an item that is an excludable item. So, I can exclude others from using this pen. Rivalry in consumption means "the property of a good whereby one person's use diminishes another person's use".
It means that, if there is a tree and this tree is all full of mangoes and if I go there and if I take these mangoes and if I eat these mangoes there are less mangoes that are available for you to take out. So, your consumption and my consumption are rivals of each other. The more I consume the less you consume, the more you consume the less I consume so, this is known as rivalry in consumption.
Now, on the basis of excludability and rivalry in consumption, we have four different kinds of goods. There are certain goods that are both excludable and rivals in consumption which are known as private goods such as clothing. Now, clothing is excludable because, I can always say that this is my cloth and I will not permit you to use it.
At the same time it is a rival in consumption because, if I purchase one piece of cloth from a shop, then it is not available for you to purchase. So, there is a rivalry in consumption, either I can have this plot or you can have this plot. When there are other goods that are excludable, but

they are not rivals in consumption, such as fire protection.
In the case of fire protection we can say that we are only going to provide fire protection to these people who are paying for it. So, we can always say that if there is a society that pays for fire protection we will provide them with fire services. If a society does not pay for it we will not provide it with fire services. But this is not a rival in consumption, because if you pay for this for fire services and you are able to get the fire services it does not mean that I will not get the fire services.
It is not a rival in consumption. So, these goods are known as club goods. Then there are certain other goods that are rival in consumption but they are non excludable such as the environment. Now, why are these non excludable because a thing such as the air now, if I am breathing air I cannot prevent you from breathing the air. It is non excludable, but it is a rival in consumption because if I add pollutants to my air, then because it is a non excludable thing and the air is there everywhere.
These pollutants will also reach you. The more I harm this resource or the more I consume this resource the less is available for you. So, this is a non excludable, but rival in consumption so, this is a common resource. And the fourth kind of good is known as a public good, such as the national defense.
It is neither excludable nor a rival in consumption, because if my country is protected, your country is also protected. So, it is non excludable and if I protect my country it is not that your country is not protected. So, it is not a rival in consumption. Now, the difference between the economic thought process and ecological thought process is that a lot of ecological thought processes occur around the common resources of the environment.
Whereas, the majority of economic thought processes occur around private goods. So, there is this major difference between the thinking of economists who are more concerned about private goods and the thinking of the ecologists who are more concerned about the common resources.
Now, we will look at an example to see that it is not that both of these thought processes are very different. We can bring the economist and the ecologists on the same page, we can bring them to a common solution that can benefit both of them and this example is one of the linear infrastructure. Now, linear infrastructure refers to those basic physical and organizational structures and facilities that are needed for the operation of a society or enterprise.
This much portion is the definition of an infrastructure, those basic physical and organizational structures and facilities that are needed for the operation of a society or an enterprise. But, linear infrastructure means that they can be represented as straight or curved lines. And examples are roads, railways, power lines, canals, pipelines and so on. So, a road is an infrastructure that you can represent either as a straight line between two points or as a curved line between two points.
So, this is a linear infrastructure. So, good examples are roads, railways, pipelines, and so on. Now, it is known that linear infrastructure through the wildlife areas leads to conflicts. So, this is something that the ecologist wants to avoid. The ecology says that if you build a road in the forest area it harms the biodiversity. How does it harm biodiversity? Because animals use roads, we normally see animals on all different kinds of roads.
And if there are vehicles that are flying, then there are also accidents and animals die on getting

collided with different vehicles. So, roads are a method of killing. Roads also cause pollution in terms of air pollution, sound pollution, and light pollution. So, if there is a road then you are also harming the forest, you are harming the biodiversity. You are providing a means through which people can throw waste products into the forest, which is another harm.

Roads are barriers to wildlife movement because this wildlife area is very different from this paved structure of the road. And so, a number of times the animals who want to move from this side to this side will avoid going on top of the road. They act as barriers, they act as physical barriers, they act as psychological barriers.

And a lot of this has also got to do with the amount of or the number of vehicles that are plying per unit time. If you have a very small number of vehicles, then probably the animals are able to cross the road. If you have a very large number of vehicles then probably the animals see a wall of vehicles that is plying through these roads and they just do not cross.

But, in these central areas where the vehicle density is in between, the animal sees that ok vehicles are coming but they are not coming at such a huge density that I might be unable to cross. So, the animal thinks ok let me take a chance and cross this road, and as it tries to cross there is a vehicle that comes and hits this animal and the animal dies. So, in this middle region we have the highest number of deaths as shown in this rate curve.

And when we look at this barrier effect it also depends on a number of other factors such as traffic intensity if there is more traffic intensity there will be a wall of vehicles, the speed of vehicles, the sensitivity of the drivers whether they are using headlights or horns and so on, the presence and location of animal crossings.

If there is a road with a very heavy traffic, but then there is also a bridge and the animal can cross under the bridge so; in that case it is not very big of a barrier. Movement patterns of this species so, especially in the rainy seasons when a number of species are on the move, the barrier effect is much more pronounced.

Species specific preference of road use, there are some species that are more comfortable in using a road, there are some species that completely avoid the road. The edge features, what is the height of the embankment? If the embankment is too high the animals will be unable to get to the road.

So, that will be a very great barrier. Time of the day, time of the year and species diversity in the surroundings. Another harm, with these linear infrastructures like roads is that roads fragment the habitats. So, here you have one habitat: you were having a big habitat and now it has fragmented it into these three sections.

There was this beautiful forest but now the animals cannot cross from this side to this side. So, it has created a fragmentation. Construction of roads causes loss and destruction of habitat because to construct roads or railway lines you will have to cut off trees.

You will have to perform earth work. So, even during construction it creates a problem for biodiversity. It can lead so, this is an example of earthwork in which a big sized hole has been dug, construction causes loss and destruction of habitat. Roads also facilitate the destruction of habitat. Why? Because roads permit accessibility to different areas. So, if people can reach an area they can also come there and cut trees, they can also poach animals.

Roads also facilitate the destruction of habitat. Roads also increase interaction with humans. So, this is an example in which a Nilgai hit a vehicle, the Nilgai died on the spot but both the people that were traveling in the vehicle, were also critically injured. Roads change animal behavior. Langurs normally do not interact with humans, but because people have been feeding these Langurs, now it has changed their behavior. They always come up to beg for food. This is another example, these people are feeding these animals, they are feeding the monkeys, they are feeding the langurs, they are feeding the wild pig, they are feeding the peacock, and this is not a behavior that would be seen in an actual environment.

Normally, if you step out of your vehicle all the animals will just run away they are so afraid of humans. But in this case, the behavior has completely changed. In a number of situations there are also incidents in which the animals attack the vehicles. This is also an issue for people because one option that the ecologist might suggest is that we should reduce the speed limit.

So, if the vehicles are plying at a lower speed then there is a chance that the animals will be saved because the animals will have much greater time to cross and avoid the vehicle, avoiding the collision. But then, if we try to reduce the speed of the road then that is also having an impact on development because we normally want to go from point a to point b as soon as possible and this will hamper that.

Linear infrastructures lead to a number of human wildlife conflict situations. A human wildlife conflict occurs when the wildlife requirements encroach on those of human populations, with costs to both the residents and the wild animals. Examples include things like crop depredation, spreading of diseases, predation of humans and livestock, road accidents, poaching, habitat degradation, loss, road kills and so on.

So, what is the option that is left with us? The option to avoid these conflict situations is to keep humans and wildlife separate from each other. The option is education and awareness, the option is mitigation measures, underpasses, overpasses, canopy bridges, culverts and so on. Now, what do we mean by these mitigation measures?

Remember we said a short while back that if there is a road and this road is acting as a big barrier but there is also a bridge. So, the animals may use the bridge to cross and in that case the interaction between the animals and the humans goes down. So, the animal is saved because it avoids a collision, the humans are saved because there is no vehicle, there is no animal to harm their vehicles and they can also move at a much faster speed.

This is a mitigation option that is available, but the question is how do we ensure the implementation of this mitigation option and do we need to have this mitigation option at all places? Even for smaller animals, the answer is yes, the ecologists would say yes. These smaller animals play a very big role as scavengers and if these animals were not there then, we will have a very big problem of dead animals that are not being disposed of.

Now, either the economist and the ecologist might go on disputing these facts or the other option is to bring them both to the same page and to make the economist realize that these mitigation measures not only protect the animals, but they also increase surplus. They enhance the surplus of the society. Why? Because they lead, they reduce the chances of human deaths and accidents.

Vehicles ply at higher speeds which leads to economic prosperity. It also aids in the conservation

of biodiversity which has its own benefits for enhancing the surplus of the society. Now, the point to emphasize here is that the mitigation measure is not just a tool of conservation, it is also a tool of good economics, and this is why it is important to understand economics.

So that you can make the economist understand things in his or her language. So, if you were to portray a bridge or a mitigation measure as a way of protecting wild animals, then probably the economist might not agree. But if you portray a bridge or a mitigation measure as a means of enhancing surplus by protecting the lives of human beings, by protecting the property of human beings, by ensuring that they are able to move at faster speeds, and by giving them the benefits of biodiversity, then probably it will be a very different matter.

The economists may completely agree with your point of view. Now, similarly it is important for the ecologist also to understand that we cannot go on saying that ok this thing is important for animals so, this has to be done. Because, that is not a persuasive argument. You also have to know about economics so that you can make use of the language of economics, you can make use of the thought process of economics to portray your case in a much better manner.

So, the implementation of these tools such as the mitigation measures can be ensured through an understanding of economic decision making and incorporation of a thorough economic analysis, not just a superficial one. So, in other words we can say that economics is a good tool for good conservation. If you did not have economics you would not be able to perform conservation because nobody is going to listen to you.

And at the same time conservation is a tool for good economics, because by using the tools of conservation we are able to enhance the total surplus of the society. Now, it is important to remember here that both the economist and the ecologist are working for the same goal of enhancing the total surplus of the society, but both of us need to understand each other's controls, each other's devices.

So that we do not fall prey to the situation in which there are 2 pilots and they are not understanding each other's controls, they are looking at completely different readings. And it is important to remember here, that the solution to the issues that have been generated by "Economic" decisions.

In certain circles, it is very fashionable to say that all the harm to the environment has been done due to economic decisions that were made. Whether we talk about pollution, whether we talk about global warming, whether we talk about loss of biodiversity, there are certain ecologists who always put the blame on the economist and say that it is because of the economist that all these harms have come to Mother Nature.

But it is important for them to realize that the solution to these issues that were generated by "Economic" decisions is more Economics, and not less. It is their duty to ensure that the economists also get the point of view that these tools of conservation are also the tools of better economics and of enhancing the surface of the society.

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

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Module 5
How can Economics help?
Lecture 2
Thinking as an Economist

Namaste!
In the last lecture we saw that conservation and economics are both related to each other, both are being done for the common aim of providing more and more benefits to more and more number of people, but still in certain cases, there are difficulties, because there are some people who might consider that economics and conservation are at loggerheads. They are not serving the same process.
The solution lies in having more and more economics. The people who are there in a position of decision making, they need to be made aware that if we are doing good conservation this is also going to be bringing benefits to a large number of people. And a good example is the provisioning of mitigation structures such as underpasses for the movement of wild animals.
Now, underpasses not only provide a way for wild animals to move across a road, but they also provide protection to people, because they will not find a wild animal out there in the road, to collide with their vehicles, to destroy the vehicle and probably also lead to the death of a some human beings in these accidents.
If we do not have underpasses the other option for people to move safely is to lower their speeds. So, in a number of areas we find that there is a speed limit regulation of say around 20 kilometers per hour, but then if we go with a speed of 20 kilometers per hour that also leads to certain detriments to a large number of people. Because goods will move slowly, people will move slowly and so in such a situation doing development of the area will be more difficult.
The issue here is to bring the economists and the ecologist on the same field and come up with certain solutions through which we can find a means to satisfy both the circumstances. It is important to know the language of both these people, it is important to know the language of economists and the language of the ecologists. And in this lecture, we will have a look at the language of the economist; we will have a look at how an economist thinks and how he or she takes a decision.
In particular to use economics we must know economics and in this lecture we will look at certain terms; terms of economics or let us say the lingo of the speed. We also have a look at the methods that are employed. Now, different disciplines might be using different methods. Now there are some methods that are specific to a field; however, there are certain methods that are

common across all fields such as the scientific method. We will have a look at what kinds of methods are used in economics.
We will also try to discern what kinds of analysis are done in this field. And then we will also look at the field realities.
Let us begin with the terms. There are a number of terms in economics and to understand any field it is important that we know the language of the field. For instance when an economist says that the market is going up or the market is going down or the market is essential for such and such society or the market says. What does this market refer to? Is it referring to your local market, is it referring to the stock market, is it referring to something else.
To understand the language of an economist it is important to know the terms that an economist uses. So, for instance a market is defined as a group of buyers and sellers of a particular good of or service. It is a group of buyers and sellers which means that you cannot have a market with say just a few buyers or just a few sellers or say just one buyer and one seller that will not make a market. You require a large number of buyers and a large number of sellers.
And these are buyers and sellers of a particular good or service. Which means that we can have different kinds of markets, we can have a market for goods, we can have a market for services. In the case of a market for goods we can have a market for say a good, we can have a market for land we can have a market for construction activities. In the case of services we can have a market of education.
Now, in any of these markets there are certain people who want to procure these goods and services and these people are known as the buyers and there are certain other people who provide these goods and services to the buyers and these people who provide these goods and services are known as the sellers. Now, in any market you will have a group of buyers and a group of sellers for that particular good or service.
Then we have quantity demanded; quantity demanded of any good or service is the amount of goods that the buyers are willing and able to purchase. Quantity demanded is the amount of goods that buyers are willing to buy. So, they must be willing and they must be able to purchase, which means that when we look at quantity demanded if there is a section of buyers that says ok I am going to procure this item for say 2 lakhs of rupees, I am willing to do that, but then those buyers do not have the funds with them.
They are not able to provide this much amount of money. So, in that case we will not include that section into the computation of the quantity demanded or there might be certain people who have money with them, but they do not want to spend it on that particular good or service, and in that case as well we will not include it in the definition of quantity demanded.
The quantity demanded is the amount of goods that buyers are willing and able to purchase. Now it is very important in the case of conservation, because there is a market for a lot of goods that are to the detriment of nature and ecology. So, for instance there is a market for tiger skin. Now why is there a market for tiger skin? Because there are certain buyers who want to procure tiger skin, there are certain sellers who want to sell tiger skin.
Now, where will these sellers get the tiger skin from; of course, they will go into a forest and they will poach a tiger. Now, if there is this market and you want to curtail this market, you want

to stop this market, so it is important to know how these people are providing these goods and services, where this market is and what is the quantity that is being demanded by this market. Because to stop this market you will have to act at different levels, you will have to act at the level of the buyers.

If somebody is trying to buy these tiger skins you would have to stop them. You have to act at the level of the sellers and then you also have to act at the level of the market. Now, remember that a market is a group of buyers and sellers of a particular good or service and these days the online marketplace has also come up as a very important market.

Now, when we look at the online marketplace, at times you will find that even on the most reputed online marketplaces there might be certain people who are selling products such as a claw of a tiger or say the skin of the snake and so if you want to perform conservation you will have to act at the level of these markets as well.

So, it is important to know what is the market, who is the buyer, who is the seller, what is the quantity demanded, what is the quantity supplied and then you can even act at this level. How do you reduce the willingness of the buyer? How do you reduce the ability of the buyer to purchase a thing such as a tiger skin?

Willingness of the buyer can be reduced by say coming up with certain means of education or awareness or by say putting up a social cost, a of putting up certain excessive taxation or excessive punishment if if anybody comes to know that that such and such person has bought a tiger skin or you could even act at the level of ability.

If you know who are the buyers who preferentially try to buy a tiger skin you might try to reduce their ability to purchase a tiger skin. Now, this reduction of the ability can be through say more taxation of those people or say by freezing up of their accounts.

Now, if you freeze the account of a potential buyer. In that case this buyer is no longer able to procure the goods and so the amount of quantity demanded in the market will go down. And as the quantity demanded goes down the price will go down and it will no longer be profitable for the seller to go and poach a tiger and bring it to the market.

It is important to know what the quantity demanded is. Similarly, you need to know the quantity that is supplied, the amount of a good that sellers are willing and able to sell. So, the sellers must be willing and they must be able. Here again there could be certain sellers that are willing to sell a good such as tiger skin, but they are unable to sell it, because they do not have access to the resources, or there could be certain sellers who have the ability to hunt a tiger, but they are not willing.

And in a number of cases we find that there are people who live around a tiger reserve. So, these people have access to the tiger, but tiger conservation has been successful only because these people are unwilling to go into the forest and poach a tiger. So, we also have to work at the level of the willingness and ability of the sellers or the potential sellers. So, these are some important terms in economics.

Another term is elasticity; elasticity is a measure of the responsiveness of quantity demanded or supplied to a change in one of its determinants. Essentially if you look at say a thing such as a price elasticity of demand, it is percentage change in the quantity demanded divided by percent-

age change in the price. Essentially if there is a change in one or more of the determinants of a good then is the quantity demanded or quantity supplied does it change or not?
Now, if there is a good for which when there is a change in its determinants and the amount of quality or the or the or the quantity of goods that are supplied or the the goods that are bought, if it changes then we will say that the demand or the supply curve is elastic.
Whereas, in certain other cases if the demand or this if the quantity demanded or the quantity supplied if it remains the same then we will say that the demand or supply for such and such good or service is inelastic.
Now, it has been seen that in the case of certain goods; such as food grains, the demand and supply are very inelastic and why are they inelastic? Because even if a person has access to more funds or if the person shifts to some other place, there is a limit to how much food grains he or she can eat. And so the quantity that has been demanded is more or less fixed.
Similarly in the case of a number of industrial products, it is difficult to change the quantity that is applied on a short term basis, and so the supply of such goods and services will be called inelastic. There are also other terms such as comparative advantage externality and so on and will explore all these different terms as we move through the course.
Next let us have a look at the methods of economics. And the most important method that we make use of is the scientific method. Now, the scientific method works like this: there is an observation and any observation can lead to a question. So, for instance there is an observation that there is a market for tiger body parts. The question is, ok what are the determinants of this market?
Does this market depend on who is the buyer or who is the seller? Or does this market depend on what the currency exchange rate is? Or does this market depend on what is the level of insurgency in areas where you have the tigers?So, that it is easy to post the tigers.
There could be a number of questions that can be asked based on any observation. Now, based on any of these questions we can come up with certain hypotheses. Now, a hypothesis is a possible explanation for what is going on. Now this possible explanation could be correct or it could be incorrect, but so it be the hypothesis has to be formed.
For instance we can say we can formulate a hypothesis that there is this market for say food grains and the market for food and the amount of food grains that is supplied to this market depends on say the cost of fertilizers.
Now, it is possible to say that in this area fertilizers are very expensive as compared to the other raw materials that are needed to manufacture food grains. And so if the price of fertilizers goes up then people will be unable to procure more and more fertilizers and so the amount of fertilizers that are applied to the crops will go down and so the quantity that is supplied will go down.
But there could also be a situation that the fertilizers are very cheap as compared to say the cost of irrigation. And so there is hardly any impact of the cost of or of the price of fertilizers on the quantity of food grains that is supplied in this market. Now, whether a hypothesis is true or not it will have to be discerned, but before we get to the task of discerning why a thing is happening in a certain manner, we will first have to formulate a hypothesis.
We can formulate n number of hypotheses. We can say that the quantity of food gains that is

supplied to this market depends on the price of fertilizers or it depends on say the price of irrigation, or it depends on the price of transportation, there could be n number of hypotheses.

And then we will try to look at each and every one of these hypotheses in more detail. Now how do we look at or how do we discern a hypothesis? It is done either through experiments or through observations. Now what can be an experiment? So, suppose we wanted to see if the price of fertilizers is the most important factor that determines how much is the amount of food grains that is supplied by a seller.

In that case we can artificially pick certain farmers and we can provide them with fertilizers at a reduced rate. So, we can provide them with certain subsidies. We can tell them that ok if you purchase 1 kg of fertilizers, we are going to pay you 20 percent of the money, you will only have to pay 80 percent of the sum.

In place of a higher price now the farmer is paying a lower price and then we can formulate certain groups we can say that there is this cohort that is paying a 100 percent price, there is the second cohort that is paying 90 percent price, there is the third cohort that is paying 80 percent price and so on.

And then we can try to look at what is the amount of food grains that is supplied by these different cohorts into the market, so this can be an experiment. Or in certain cases when it is difficult to perform an experiment, we can even look at more observations.

For instance we can say that ok if everything else remains same, but then also the price of fertilizers would be varying to some extent, or probably there are different places in our area of study and in one place the price of fertilizers is more in another place the price of fertilizers is less and everything else is more or less the same.

In that case the scientist or the economist might try to figure out if these natural variations in the prices have got something to do with the quantity of food grains that these different sellers provide to the market. So, we can explore a hypothesis either through experiments or through observations.

And when we do these experiments and observations it is possible that the hypothesis gets rejected. So, it is possible that we formulated all these different cohorts, we gave them different amounts of subsidies, but still every cohort provides the same amount of food grains or supplies the same amount of food grains to the market.

In that case we will reject the hypothesis that the price of fertilizers has the majority share in determining the amount of food grains that are supplied by the seller to the market.

This is a hypothesis that gets rejected through either the experiments or through the observations. And when this happens then we will go ahead with the next hypothesis or we will even formulate a new hypothesis. So, in this case we might say that the price of fertilizers has nothing to do with the quantity of food grains that these people are supplying, so probably it is the price of transportation. So, that is the new hypothesis that the price of transportation governs the quantity of food grains that are supplied by the sellers to the market. This is the next hypothesis.

And what do we do with this hypothesis? We repeat the process, we go ahead with more experiments and observations. And we perform these two operations of formulating hypotheses and checking them out through experiments or observations till we have reached a point where the

hypothesis gets confirmed.
Suppose our hypothesis that the cost of transportation determines the quantity of food grain that is supplied to the market. Suppose we are able to prove this hypothesis in our study area, so in that case we will formulate a theory.
Now, this theory would say that the cost of or the price of it of transportation determines the amount of food grains that is supplied to the market, but then it is also possible that this theory is only applicable to the current area of study. It is not applicable everywhere else. In that case it will remain at the level of a theory, but then if a theory stands the test of time.
So, we test it in different locations, we test it in different periods of time, we test it under different circumstances and every time we find that it is actually the price of transportation that determines the quantity of food grains that are supplied by the sellers to the market. If that happens then we will upgrade the theory to the level of a law and then we will call it the law of say governance of the quantity of food grains supplied to the market.
Another example from a very different field is that suppose you have a torch and this process is not working, how do you apply the scientific method?
Now, remember that the scientific method's aim is to help you get to the correct conclusion. So, your torch is not working and there could be n number of things that are wrong with the torch. Probably the batteries have died out, probably the bulb has got fused, probably the switch is not working, probably the wires are broken, there could be a number of things. Now, we can apply scientific methods to any observation and to any question.
In this case the observation is that the part was not working, the question is why is the torch not working? So, we will formulate certain hypotheses, the first hypothesis is perhaps the battery is dead. Now, how do you check whether this is the correct hypothesis?
Will you change the battery or you charge the battery and check if the torch works. Now if the torch still does not work then our hypothesis that the battery is dead is wrong, because if this hypothesis was correct the torch should have worked when you change the battery or when you charge the battery.
So we reject this hypothesis that the torch is not working, because the battery is dead. Then we come up with another hypothesis that the torch is not working, because the bulb has been fused. So, we change the bulb. So, this is the experiment, you change the bulb and check if the torch works.
And you find through this experiment that the torch still does not work which means that the bulb was not fused, because you have changed the bulb in that case. So, one by one we are formulating a hypothesis, we are testing the hypothesis and we are accepting or rejecting the hypothesis.
If the bulb is not fused then perhaps the switch is not working. So, in that case the experiment is you change the switch and then check if the torch is working. And now through this experiment you come to know that the torch is working. In that case you can through this method of testing out different assumptions, different hypotheses, one by one you can reach a conclusion about why while you were observing the observation that you were observing.
That is through looking at all of these hypotheses one by one you can come to the conclusion that

your torch was not working because its switch was malfunctioning, which you could not have done if you looked at all of these different aspects at the same time.

So if you have a torch that is not working and you wanted to check the bulb, you wanted to check the battery, you wanted to check the switch, you wanted to check the wires, everything at the same point of time then it would have been very difficult to come to the conclusion or especially the right conclusion about why your torch is not working. Now, similarly in the field of economics there are a number of questions, there are a number of observations and the economist uses the scientific method to understand or to explain why a certain thing is behaving in the way it is doing.

We have observations about things such as inflation. Why does inflation occur? Why do we have unemployment in our society? And all of these questions are understood through the scientific method.

And if any of these theories stands the test of time then we say that we have come up with a law. So, if you want to understand how an economist thinks, it is important to know the scientific principle and to deploy scientific principles in different circumstances.

Now in the case of economics the experiments are in a number of cases a natural experiment. Now, natural experiment means that, especially because economics has got a lot to do with different people. So, you cannot, say, subjugate a person to malnutrition or you cannot subjugate a person to poverty, just to test if a certain observation is because of a certain hypothesis, because there are human costs involved.

If you wanted to check if the price of crude oil has got something to do with, say an observation x, you cannot just go ahead and increase the price of crude oil. Because one; in a number of cases, you will not have access to the power to increase the price of crude oil and two because of the human costs that are involved. So, the economist in a number of cases makes use of natural experiments.

What is a natural experiment? Out there in nature even without us doing anything there are variations. So, suppose somebody wants to understand the role of poverty he or she can look at two different areas; one in which more and more people are poor and the other area where people are less poor. Or if somebody wanted to understand the impact of an increase in the price of crude oil then they only have to look at those periods of time such as wars, where the price of crude oil goes up.

So, these natural experiments can be made use of in understanding and checking any hypothesis. And in the scientific method we also make use of assumptions and models why? Because if you look at the scientific method you will find that there are a number of hypotheses that need to be tested and if we do not make certain assumptions then there will be so many hypotheses that it will be very difficult to check any of those.

So, for instance if you wanted to check if poverty has got something to do with the amount of education that people receive. So, and when you are doing any experiment or when you are looking at a natural experiment then it is possible that not only are these people poor, but probably they are also living in say a nation with a very different political principle. So, we are looking at one one society that is living in a capitalist country and another society that is living in a communist

country.
Now, if a number of things are different between both of these societies then we cannot pinpoint whether the amount of education that people are receiving is because of poverty or not. So, we will have to make the assumption that everything else being constant poverty has so and so impact on education, and so this is an assumption that we need to make use of.
Similarly, we also make use of a number of models. Now, what is a model? A model is a simplified depiction of reality. So, for instance if you look at say the climate of India, then a model would say that ok in the months of May or June you have the summer season, in the months of December and January you have the winter season, but the reality could be different, the reality would be that in case of December and January being winter months you could be having a winter from say 15th of November or a winter that extends till the end of February in certain years.
But then if we want to discern the rule of something we will have to simplify things. If it is very much complicated then and then looking at or making pinpointed conclusions would become more difficult. And so we make use of models which are simplified versions of reality.
A model can be defined as a simplified description, especially a mathematical one of a system or a process, to assist calculations and predictions.
Io, it is a simplified description. So, you are removing most of the complexity, especially a mathematical one. Now why do we prefer mathematical models? Because a mathematical model makes it much easier to predict things, it has a better predictive power. So, a model is a simplified description, especially a mathematical one of a system or a process. And why do we make a model? To assist calculations and predictions. It makes calculations easy and it gives us a certain amount of predictive power.
Why do we use models? Models are simple to understand by removing the specifics. So, in the case of the climatic model you are removing the specifics about which date or say on which date what was the temperature. We are just looking at a very simplified depiction when we say that so and so months are summer months, so and so months are winter months and then spring and autumn and so on.
So they make things simple to understand by removing the specifics. They help us concentrate on the most relevant variables. So, for instance if we wanted to check whether a particular activity is more in the summer season and less in the winter season. So, if we made use of this model, we do not have to concern ourselves with what was the exact temperature on that day, what was the exact humidity on that day.
Now, remember that all these different factors could also have a bearing on our observation. But then by removing all of these variables, we are making it simple to understand and we are concentrating on the most relevant variables. It promotes reflection and clarification of ideas, it gives a certain amount of explanatory power.
Through a model we can explain things and we can even predict what is going to happen in the future. If we have a simplified model it is easy to to understand things, it is easy to explain things to others and it is also easy to predict what is going to happen in the near future.
But then when we are simplifying things, we are also removing a lot of details. So, this is a limitation of models. Most of the models are approximations; they are not exactly how the real-world

functions. And remember that this is ok because we made a model, knowing that we are unable to comprehend the complete reality and model will help us understand the reality, and so there will be certain limitations. Then there is a tradeoff between accuracy and predictive power and simplicity.

Now, if you have a model and you want to be extremely accurate then you will have to consider all the smaller variables that were also playing a part, but then if you include all the smaller variables then your model becomes so complicated that it becomes difficult to comprehend and difficult to explain and probably even difficult to deploy. So, there is always a tradeoff, between accuracy and predictive power on one hand and simplicity. With more predictive power complexity goes up which might defeat the purpose of the model.

Let us now have a look at certain models that we commonly use in economics. The first one is the circular flow diagram. It is a visual model of the economy that shows how money flows through markets among households and firms. So, a circular flow diagram is a visual model. It is a model and it helps you to visualize things. It is a model of the economy and it shows how money flows through markets among households and firms.

What does this model say? This model says that there are two big entities; there are firms and there are households. Firms are those entities that produce and sell goods and services. So, they are the producers and they are the sellers of goods and services. Now, to produce these goods and services they hire and make use of factors of production. So, you can understand a firm easily by visualizing say an industry.

Now, an industry is manufacturing certain goods or it is providing certain services, and to manufacture these goods and services it requires labour. So, how will it get labour, it will hire labour, it will employ people. A firm is the set of entities that produce goods, that produce and sell goods and services and for production, they hire and use the factors of production. Factors of production means they are using land, labour and capital.

The other big entity is the households. Households are those entities that buy and consume goods and services. So, these are the buyers of goods and services. They own and sell the factors of production. So, the households own their own labour and they sell their labour to the firms to help them produce things and in return they will be getting a salary or the households are those entities that own the land and they will make this land available to the firms in exchange for say a rent.

Households buy and consume goods and services, they own and sell the factors of production. So, there are these two entities. Now these two entities interact in the market, and remember that a market is the place where buyers and sellers are coming together, but markets are places where buyers and sellers of a particular good or service come together. So, in this case we can clarify that there are two different markets; there are markets for the goods and services.

Now, goods and services are those things that the firms are producing and the firms are selling. On the other hand the households buy these goods and services. So, in the market for goods and services, the goods and services are sold by the firm in this market and they are bought by the households. Now, when the households are buying the goods and services from this market, they will have to make a spending, they will have to pay something.

So, let us say that they are paying in rupees. So, one rupee is moving from this household to the market, because a certain portion of goods and services are being bought by the households in this market. And this market is then channelizing this rupee to the firm and the firm is getting this money in the form of revenue. So, this is the revenue of the firm. And why is the firm getting this revenue? Because it is selling goods and services. So, this is one market in which the firms and the households interact with each other.

Now, if you do not have any other market, if we have only one market, then there will be a situation where the households will very soon end up all the money that they have, all the money will get accumulated here and the households will only have certain goods and services that they have bought from the firms. So, after a while this economy will stop. Now the reason why the economies do not stop is that we have another market which is known as the market for the factors of production.

Now, in the market for the factors of production the firms buy and the households sell. Now what do the firms buy? The factors of production. So, the firms are buying the labour of people who reside in the households, or the firms are buying the land or they are renting the land that is owned by different people. So, the firms are buying here and when the firms are buying, they will be spending the money that they have.

In this case the rupee is moving from the firms through this market of production into the households the. So, the firms are paying the wages, rent and profit. So, if there is labour that is being purchased. So, in exchange for labour the firms will be paying wages. If there is land that has been purchased or rented then the firms will be paying the rent. If there is capital that has been purchased then the firms will be paying for through their profits.

So, in this market for factors of production the firms are buying the factors of production and they are selling or they are paying for it through various rent or profit. On the other hand these factors of production are being made available through the households. So, the households are selling land, labor and capital and in exchange for it they are getting the income.

So, this is a circular flow diagram, because if you look at say the flow of money it moves from households through the market to the firms then through the second market back to the household. So, it completes a complete circle.

On the other hand, if you look at the flow of inputs and outputs, we will find that the inputs and outputs are going through this circle. In both the cases the circle is complete, and so this is the circular flow diagram of an economy.

Packet of milk: identify this transaction on the circular flow diagram. What is Hari in this case? Hari is a part of the household and Hari is paying a dairy for the packet of milk. Dairy is producing and selling this packet of milk. So, the entity that produces and sells goods and services is the firm and the entity that buys these goods and services is the household.

In this example the dairy is the firm and Hari is the household and Hari is paying 60 rupees for this packet of milk. The first thing to understand is whether this is the market for goods and services or whether this is the market for the factors of production. Now, the answer is, in this market the firm is selling things to the household, and so when the firm is selling things to the household it is the market for goods and services.

In this market for goods and services Hari who belongs to the household is spending 60 rupees in this market and the firm which is the dairy is getting a revenue of 60 rupees. And if you look at the flow of inputs and outputs the firm is selling the goods and the goods in this case which is a packet of milk and the household which is Hari is buying this good which is a packet of milk.

Now, where does Hari get this money from? So, Hari earns say 15000 rupees working as a waiter in a restaurant. Now identify this transaction on the circular flow diagram. In this case Hari is earning something, working as a waiter, which means that Hari is providing his labour.

So, he is selling his labour and in return for selling his labor he is getting 15000 rupees. And who is Hari selling this labour to? He is selling this labor to a restaurant. So, in this case the firm is the restaurant or the restaurant is the firm, because firms hire and use the factors of production.

In this case the restaurant is hiding the factor of production which is Hari and using Hari as a waiter. So, the restaurant is the firm, Hari is the household, because Hari is owning and selling the factor of production which in this case is his own labour. This interaction is occurring in the market for the factors of production where the firms buy and the household sell.

Now Hari is selling his labour to the firm, so the firm is procuring the factor of production which is labour. And the 15000 rupees that Hari gets is his income that is deriving from this market of four factors of production and this income is coming through these firms. So, the firms are paying this money in the form of wages.

So, the restaurant is paying wages and these wages become the income of Hari who is the household, a part of the household. So, this is the circular flow diagram.

Now, why is this a model? Why do we call it a model? Because this is a very simplified representation of the working of the economy. The economy is not this simple, because in the circular flow diagram we do not see the government anywhere. So, it does not consider the role of the government.

The government may be providing, maybe collecting taxes, the government may be providing subsidies, the government may be putting certain controls on these markets and on farms and households, but the circular flow diagram is neglecting all of these issues.

It is possible that out of this revenue there is a certain portion that is going to the government. When the households are spending, probably the government is taking the share. When the households are getting income probably there is an income tax that is being paid, but a circular flow diagram is neglecting all of these entry cases and is simplifying things and so this is a model. It also does not consider the role of international trade, because in this model we are considering that this economy only comprises these two entities: the firms and the households.

And we are not considering those goods and services that are being brought from outside. So, it neglects imports and exports.

Another model that we routinely make use of is the production possibilities frontier. Production possibilities frontier is a graph that shows the combinations of output that the economy can prove can possibly produce given the available factors of production and the available production technology.

So, is it a graph or a chart and what does it show? It shows the combination of output that the economy can possibly produce. So, it shows us what the combination of different outputs that the

economy can produce, the constraint of the available factors of production and the available production technology. So, given the available factors of production and given the production technology of the time and phase, what are the different combinations of output that can be produced is shown by the production possibilities frontier.

Now, let us say that there is an economy and for simplicity's sake there are only two goods that can be produced with the technology and with the factors of production. The first good is say computers and the second good is cars. Now, we are simplifying things because we are saying that in this economy, we have only these two items that have been produced. There is no third item because we are trying to understand how the factors of production are allocated.

So we make the simplification that there are only two items. Then the second simplification is that any factor of production can be used in making either of these goods. So, for instance if there is a worker, we can use that worker to produce computers or we can use that worker to produce cars. Now, this again is a big simplification, because in a number of cases the workers who are trained to make computers might not be that trained in making cars, but then this is a simplification that we are using.

Similarly, a number of items that are used in the manufacturing of cars are very different from those that are used in making computers. So, for instance we use silicon in the IC chip that is there in the computers. Now silicon is hardly used in cars. But then when we are making this model of production possibilities frontier, we are saying that any factor of production can be used in making either of these two goods.

Now, suppose the economy decides that we are only going to produce computers. In that case it produces zero cars and it produces 3000 computers. So, that is one production possibility. If you do not make any cars, if you put all your resources into making computers you will make 3000 computers. On the other hand if you put all the resources into making cars you will make say 1000 cars. So, this is the other extreme of this production possibility frontier.

Now, if you spend say 50 percent of your factors of production into making computers and 50 percent into making cars then there will be some other point. If you spend say 10 percent and 90 percent there will be some other point. So, all the points that represent what all things can be manufactured are shown by this line. So, a point such as this will tell us that the economy is currently producing 700 cars and 1200 computers.

Similarly, this point is also possible. All the points that are inside the curve to the left of the curve are also possible, but we say that these are inefficient use of resources, because the resources are not being put to complete use. So, for instance the economy might say that we will be producing say one computer and one car ; however, they could have even produced 700 cars and 1200 computers, but in place of producing 700 and 1200 items they are only producing one. So, that is possible, but that is inefficient.

So, the production possibility frontier tells us the most efficient production of two different goods that the economy can make. Any points that are to the right of this curve are an impossible combination, because the resources and technology are not available to make so many goods or services. So, this is a simplified model that we refer to as the production possibilities frontier.

Now, such a model helps us understand the principles of economies, because here what we are

emphasizing is that the society is facing a tradeoff, what is that trade off? The society wants more cars and more computers, but there is a limit and so the society can either have more computers or it can have more cars. So, it will have to make a tradeoff between computers and cars. The second thing is that tradeoffs are leading to cost and cost is what you give up to get something.

So, in this case you are giving up 3000 computers to make 1000 cars. So, the cost of 1000 cars is 3000 computers or the cost of 3000 computers is 1000 cars. So, this is the cost. So, this model is helping us understand concepts such as tradeoffs and concepts such as cost.

The cost in this case is the opportunity cost. If the society wants more computers it will get less number of cars, and when the society chooses to make only computers the best workers for car production are also used in making computers. But they may not be that good in producing computers, because they are not trained in producing computers which produce the bow shape curve. Putting these workers into car production will not only greatly impact the number of computers produced, but will also greatly increase the number of cars produced.

What we are saying here is that specialization is also being depicted on this curve, because of this shape. Now, in place of producing 3000 computers suppose you could suppose the society produced say 2900 computers. So, we will get a curve like this and the point where this line cuts this curve is this.

So, what we are seeing here is that just by reducing 100 computers we are getting say close to 200 cars why? Because when we are leaving out certain workers from computers into making cars, in a number of cases they will be those workers who are more capable and willing to produce cars, and so we are seeing an effect of specialization.

If the society decides to make only one thing then even those people who are not that specialized to make that item will be used in the manufacturing of that item which will not be the most efficient utilization of resources. So, we are seeing an inefficient utilization of resources when society chooses to make only computers or only cars. So, this is another concept that we are observing through this curve.

Now why is this a model? Because this is a simplified representation of the working of the economy. Almost no economy is there that only produces two goods. Most of the economics produce hundreds of thousands or millions of goods, but then to understand the role of allocation of resources or to understand the opportunity cost or to understand specialization, we have looked at an economic economy that makes only two items.

Similarly, not all factors of production can be equally deployed in making of these two items, but then this is another simplification that we have made, but these simplifications permit an easy grasp of economic ideas of scarcity, efficiency, trade off, opportunity cost and economic growth.

How economic growth? Suppose there is the availability of better technology, and so the economy in place of making 3000 computers can now make 4000 computers.

Now, remember that when we started with the production possibility frontier, we said that given the available factors of production and the available production technology. So, this is an assumption in this model. What happens when we break these assumptions? If we say that we make more people available or we say that we make available better technology. So, in that case

the total amount of computers that can be produced now will increase from 3000 to 4000.
Now, when this happens, the curve the production possibility frontier shifts from here to this red line. When that happens now if you look at these two points, earlier the society could have 700 cars and 1200 computers, but now this point is also possible that the society can have 750 750 cars that is more number of cars and 1400 computers that is more number of computers.
Now the economy: this society can have more computers and more cars even though the technology has only increased the number of computers that can be made. Now, this is an example of economic growth. Now in the economic growth more and more people can have access to more and more items. So, in place of this point 700 and 1200 now we have 750 and 1400. This is an example of economic growth.
We can understand economic growth by looking at this production possibility frontier. Next, let us have a look at the economic analysis. Now economics does analysis at two different levels; the first is the level of microeconomics. Microeconomics is the study of how households and firms make decisions and how they interact in the markets. So, in the case of microeconomic analysis we will concentrate on a single firm or we will concentrate on say a single household and we will concentrate on a market in which these are interacting.
In macroeconomics we look at the impacts of all of these different combinations by all the households and all the firms in all the markets. So, macroeconomic phenomena, including inflation, unemployment and economic growth. So, in microeconomics we are looking at things at a micro level at a small level. So, we are asking the question: how do you decide, or how do I decide whether to buy item one or item two? Or how does a firm decide whether to produce item one or produce item two and how much amount to produce? So, questions such as these are asked in the field of microeconomics.
So, it concentrates on either one household or say a firm or on a market. Macroeconomics looks at things from a wider level and it looks at the impact of the interactions and the activities of all the households, all the firms and all the markets in the economy. And so in that case we can understand concepts such as inflation, unemployment, economic growth and so on. Another aspect of analysis is that economics can make use of positive analysis or it can make use of normative analysis.
Now positive analysis is an analysis that claims that the attempt to describe the world is as it is as a scientist; such as minimum wage legislations increase unemployment. So, in this case we are not saying whether this should be done or that should be done. We are just giving things as a matter of fact that in this case minimum wage legislation increases unemployment. This is the fact that we are putting up, so this is a positive analysis. A normative analysis claims to attempt to prescribe how the world should be as a policy advisor.
If I say the same sentence and if I put it as minimum wage legislations should be removed when I am talking about a normative analysis. Because I am talking about the way things should be, it should be removed. Now, all that being said there are certain field realities also that we need to be aware of. Economic advice is not always followed, sometimes other considerations such as votes or private profits or lethargy may hold sway.
If there is an economic analysis that says that minimum wage legislations should be removed, it

does not mean that the minimum wage legislations will be removed, because you also have to look at other factors; such as politics or the level of society of that area and so on. The second thing is that the economists themselves disagree a lot why? Because of differences in which scientific theory to follow, differences in their value judgments. Example whether to choose efficiency or equality because in a number of cases the economists themselves are doing a normative analysis.

For instance a person who puts much faith in increasing efficiency might say that minimum wage legislation should be removed. On the other hand another economist who emphasizes on the level of or or on the quality of life of these labourers might say no; minimum wage legislations are extremely important otherwise these people might get exploited.

Now, both of these economists are correct in their own opinions. They are correct in their own places, but they have a difference in the value judgments, whether they are trying to emphasize the efficiency of the economy or whether they are trying to emphasize the level of equality that is there in the society.

So, these are certain reasons because of which the economist might themselves disagree. So, you have to take everything with a pinch of salt. So, in this lecture we had a look at how an economist thinks, what are the different kinds of models, what are the different kinds of analysis that we make use of, certain terms that belong to the screen and so on.

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

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Module 5
How can Economics help?
Lecture 3
Interdependence and gains from trade

Namaste!
We carry forward our discussion. And in this lecture, we will explore Interdependence and Gains from Trade. One question in economics that we should think about is why should people go for a trade. If I can do everything by myself should I not be doing everything by myself or are there certain advantages that I can gain by going for a trade, that is I do something, you do something, I give something to you, and you in return give something to me. So, that is trade.
And we begin this lecture by exploring what Adam Smith had said about trade. Why trade? It is a maxim of every prudent master of a family, never to attempt to make at home what it will cost him more to make than to buy. So, here Adam Smith is saying that for any prudent master of a family.
Remember that we had said that in economics we consider that everybody is a rational person. So, if somebody is rational, if somebody is prudent then what the prudent person does is that he or she never attempts to make at home what it will cost him more to make than to buy, which means that if suppose you can make potato chips at home or you can buy it from outside. Now, if you can make potato chips and if it is costing you 100 rupees for 1 kg of potato chips.
But when you go to the market you can find it for say 80 rupees. So, in that case it makes more sense to buy it from the market. So, it is a maxim of every prudent master of a family never to attempt to make at home, what it will cost him more to make than to buy. The tailor does not attempt to make his own shoes, but buys them of the shoemaker. Why? Because the shoemaker probably is able to make it at a cheaper cost especially because the shoemaker is in the profession of making the shoes.
He has all different kinds of equipment, he has sufficient training that is required to make the shoes. Now, because of having better equipment, because of having better training, the shoemaker is able to make a shoe for much cheaper than what it would have required the tailor to make a shoe.
So, the tailor does not attempt to make his own shoes, but buys them from the shoemaker. The shoemaker does not attempt to make his own clothes, but employs a tailor. Why? Because here again for making clothes it will require a very different set of equipment, it will require a very different set of training. And probably the tailor has those equipment, probably the tailor has that

training because of which he is in a much better position to make clothes much cheaper.
In this case the shoemaker buys the clothes from the tailor. He does not attempt to make the clothes by himself. The farmer attempts to make neither the one nor the other, but employs those different artificers. That is the farmer when he has to buy shoes, he goes to the shoemaker. When he wants to have clothes, he goes to the tailor. He does not attempt to make shoes or attempt to make the clothes because he is not a specialist, he does not have the equipment, he does not have the training.
And if he tried to make clothes or shoes then probably it will cost him much more than buying it from the market or from the tailor or from the shoemaker. Especially because in the case of a number of articles the equipment that is required are costly. So, probably the former can buy a pair of shoes for say 500 rupees.
But the equipment that is needed to make those shoes probably costs say 2 lakhs of rupees. Now, in that case it does not make any sense for the farmer to buy these equipment for 2 lakhs of rupees when he can buy a pair of shoes for just 500 rupees. So, this is what Adam Smith is saying.
The farmer attempts to make neither the one nor the other, but employs those different artificers. All of them find it for their interest to employ their whole industry in a way in which they have some advantage over their neighbours. So, everybody finds it in their own interest to employ their own industry, that is to devote their time and to devote their effort in something in which they have an advantage over their neighbours. And to produce with a part of its produce.
And to purchase with a part of its produce or what is the same thing with the price of part of it, whatever else they have occasion for. So, it is in the interest of everybody to spend their time and effort in something in which they have an advantage over their neighbours.
So, the tailor is spending his time and effort in making clothes because he has an advantage over the shoemaker and over the farmer in making clothes. So, if he makes clothes much more cheaply or in other words on any particular day he can make many more clothes than could be made by say the shoemaker or the farmer. So, in this case the tailor has an advantage over his neighbours in making clothes. Similarly, the shoemaker has an advantage over the tailor and the farmer in making shoes.
So, it is in the interest of everybody to employ their whole industry in a way in which they have some advantage over their neighbours. But because you require other things as well because the tailor requires shoes. So, what will he do? He will produce an excess of cloth he will then give these clothes to his neighbours.
And in exchange he will get the shoes or the food grains. So, he will purchase with a part of its produce which means that he is having an excess of cloth and he will use some part of this production that is these excess of clothes to purchase the other things. Now, in place of giving clothes the other way out is that he can use the price mechanism. So, with it he gives a cloth or whether he sells those clothes and gives the money is one and the same thing.
To purchase with a part of its produce or what is the same thing with the price of part of it whatever else they have the occasion for. Whatever else he wants to purchase he will use his excess clothes or he will use the money that he is getting from selling these excess clothes to purchase whatever else he needs.

Now, this is something that we observe on a day to day basis. So, nobody tries to do everything because it is in their own self-interest. But what this small story is telling us is a few salient points. People do not make anything or do not do something in which case it will cost them more to make than to buy. So, this is the first thing. If there is something that you can procure at a cheaper cost than that of making then probably you will go for procuring it. And why do people do that? Why? Because people are rational beings.

So, any rational person would try to maximize his or her own resources. And so, if he or she can get something cheaply from some other place then they would prefer to get it than making everything by themselves. And why are they doing it? Because they are finding it in their interest.

In this case what Adam Smith is hinting is that they are not doing it because of a benevolence. So, the tailor when he is giving the clothes to the shoemaker in exchange for a pair of shoes, he is not giving these clothes by means of benevolence, he is not trying to help out the shoemaker. He is acting in his own interest. So, when we talk about trade it is in the interest of everybody and nobody is doing it for benevolence. So, all of them find it for their interest.

And what do they do? They do something in which they have some advantage over their neighbours. So, he is hinting that if there is an advantage that could be an absolute advantage or a comparative advantage. But if you have an advantage over your neighbours in doing something.

Then you should be doing that and not doing things in which you do not have an advantage because you are thinking rationally. Now, it is easy to understand trade if one person can only make one kind of good. So, if we have a situation in which it is only the tailor who can make clothes, the farmer cannot make any clothes, the shoemaker cannot make any clothes, and the shoemaker can make shoes, but the tailor cannot make any shoes the farmer cannot make any shoes because of whatever reason.

So, it could be that in this society it is prohibited for any person other than a tailor to make a cloth. Now, if you have a situation such as this then no doubt trade is inevitable because there is no way out that a tailor could have access to shoes other than by the means of trade because it is prohibited for him to make shoes. Or probably the only sewing machine in the society resides with the tailor and he says I am not going to give it to anybody else.

In such a situation there is no way that the shoemaker would have access to clothes, if he did not trade with the tailor. So, what we are saying here is that if there are say 2 formers and there are 2 goods, one is milk the other good is potatoes. Now, farmer 1 can produce any amount of milk in a day, but he cannot produce any potatoes and farmer 2 which is shown in this green color can make any amount of potatoes, but he cannot produce any milk.

So, what happens in this case? There is no way for farmer 1 to have access to potatoes if he does not get them from farmer 2, and similarly there is no way farmer 2 can have access to any amount of milk if he or she is not trading with farmer 1. So, if one person can make one sort of good and no other person can make that particular good then trade is inevitable. There is no way that trade would not happen in such a society. But the question is in the real world we do not find such a situation.

So, in a number of cases we can observe that a farmer can produce milk because he or she can have few cattle in his home or the farmer can produce potatoes as well. Now, the question is will

they still trade if they can make both the things. So, we have a situation like this. So, we are saying that the farmer 1 can produce milk, but he is much better at producing milk than potatoes. Whereas, farmer 2 can produce potatoes he can also produce milk, but he is much better at making potatoes than milk.

Now, in this case what we are saying is that these farmers have different absolute advantages, that is the farmer 1 if he spends his time in producing milk then he can make much more amount of milk in a day than farmer 2. So, suppose both farmer 1 and farmer 2 decided that they are only going to produce milk. So, in that case farmer 1 will be producing this much amount of milk and farmer 2 will be producing this much amount of milk.

So, what we are seeing here is that farmer 1 has an absolute advantage in the production of milk. And similarly farmer 2 has an absolute advantage in the production of potatoes because farmer 2 can make this much amount of potatoes in a day, whereas farmer 1 could only produce this much amount of potatoes in a day.

So, if there is a difference in absolute advantages. What is the absolute advantage? The ability to produce a good using few inputs a fewer inputs than another producer. So, in this case, what we are observing is that to produce a quantum of milk. So, let us say that both the farmers have only 8 hours in a day in which they can work.

Now, let us suppose that farmer 1 can make say 8 litres of milk in a day, so in an hour he can make 1 litre of milk. Whereas, farmer 2 can only make 2 litres of milk in a day. So, what we are hinting here is that for farmer 1 he can make 8 litres of milk in 8 hours. And farmer 2 can only make 2 litres of milk in 8 hours.

So, this much is 8 litres of milk and this much is 2 litres of milk. Now, this would mean that to make 1 litre of milk the time required is 8 hours divided by 8 or 1 hour. Now, the input that is required to make 1 litre of milk in this case is 1 hour in the case of farmer 1. Whereas, in the case of farmer 2 what we are observing is that to make 1 litre of milk.

The farmer requires 8 hours divided by 2 litres which is 4 hours. So, in this case what we are observing is that farmer 1 can make 1 litre of milk using fewer inputs: just 1 hour of input whereas, farmer 2 can make 1 litre of milk using a larger amount of inputs that is 4 hours. So, in this case, the farmer 1 has an absolute advantage because he has the ability to produce a good, in this case the good is 1 litre of milk using fewer inputs than another producer.

Well, in this case the input is the time that the farmer is putting in. So, farmer 1 has an absolute advantage in milk production. Now, similarly in the case of potato production we will find that farmer 2 has an absolute advantage because let us say that the farmer 2.

Let us suppose that this much is 24 kg of potatoes and he is making 24 kg of potatoes in 8 hours. Whereas farmer 1, if he spends all his time all the 8 hours in making potatoes then probably he is able to produce only 4 kgs of potatoes in 8 hours. (Refer Time: 17:20) when there is one farmer who has an absolute advantage over both the goods.

Now, in this figure what we are observing is that the production possibility frontier for farmer 1 is here in red and for farmer 2 is here in green. Now, in this case when both the farmers are only producing milk, then farmer 2 can make 24 litres of milk in 8 hours, whereas farmer 1 can only produce 8 litres of milk in 8 hours.

Here we are observing that farmer 2 has an absolute advantage over farmer 1 in the production of milk, that is we can make milk using fewer inputs. In this case, if you look at the time that would be required, so for farmer 2 in 8 hours he can make 24 litres of milk which means that to make 1 litre of milk he requires 8 by 24 is 0.33 hours Now, this is the input in terms of time that he requires to make milk 1 litre of milk. Whereas, farmer 1 for him in 8 hours he is making 8 litres of milk.

To make 1 litre of milk he requires 8 by 8 which is 1 hour. Now, in this case, it is easy to see that farmer 2 has an absolute advantage over farmer 1 because he can make the good in this case 1 litre of milk using fewer inputs that is just one-third of an hour as compared to the second as compared to farmer 1. So, farmer 2 has an absolute advantage here farmer 2 has absolute advantage. Now, this is for milk production. Now, let us look at potato production.

Now, in this case farmer 2 in 8 hours if he only produced potatoes he would have made 48 kg of potatoes. So, to make 1 kg of potatoes he requires 8 by 48 which is 1 by 6 hours or 10 minutes. Now, let us look at farmer 1. Farmer 1 in 8 hours if he only produced potatoes he would have produced 32 kgs of potatoes, which means that to make 1 kg of potatoes he requires 8 by 32 is 0.25 hours which is 15 minutes. Now, in this case, when we talk about potato production.

Farmer 2 requires 10 minutes and farmer 1 requires 15 minutes. So, here again we are observing that farmer 2 requires less inputs, he requires only 10 minutes of input, whereas farmer 1 requires 15 minutes of input. So, in this case farmer 2 has an absolute advantage. So, what we are observing here is that when we talk about potatoes, farmer 2 has an absolute advantage, when we talk about milk farmer 2 has an absolute advantage. So, farmer 2 in this case is having an absolute advantage.

In both these goods potatoes as well as milk. So, now the question is if farmer 2 is more efficient at producing potatoes and he is more efficient in producing milk as well, should he go for a trade. Does it make any sense for both of these farmers to go for a trade? And that is the question.

And as we will see, yes, here again there is an advantage. Then both of them went for a trade. So, here we come to the concept of comparative advantage. So, absolute advantage as you remember is the ability to produce a good using fewer inputs than another producer and in this case farmer 2 has an absolute advantage over farmer 1 over good the goods. But then there is a difference in comparative advantage. Comparative advantage is the ability to produce a good at a lower opportunity cost than another producer.

Comparative advantage is the ability to produce the good at a lower opportunity cost, not using fewer inputs, but at a lower opportunity cost than another producer. And in this case, opportunity cost is defined as whatever must be given up to obtain some other item. So, if we look at this curve again, farmer 2 could produce 24 litres of milk in 8 hours.

If he devoted his time completely to the production of milk. Or he could have made 48 kgs of potatoes, if he spent all his time making potatoes which means that for farmer 2, 24 litres of milk is equivalent to 48 kgs of potatoes. And for farmer 1, he could have spent his 8 hours either to make 8 litres of milk or to make 32 kgs of potatoes.

Now, which means that for farmer 1, the milk production could be as high as 8 units. So, farmer 1, the milk production is as high as 8 units and the potato production is as high as 32 kgs. The

potato production is 32 kgs. So, the opportunity cost for 1 unit of milk production is 32 by 8 which is 4 units of potatoes. So, this is the opportunity cost. What is he giving up? To make 8 units of milk he is giving up 32 units of potatoes. So, to make 1 unit of milk, he is giving up 32 divided by 8 is 4 units of potatoes.

So, this is the opportunity cost for farmer 1 for 1 unit of milk production. And similarly, the opportunity cost for 1 unit of potato production is 8 units of milk divided by 32 is 0.25 units of milk. So, these are the opportunity cost for farmer 1. The opportunity cost for 1 unit of milk is 4 units of potatoes and the opportunity cost for 1 unit of potato is 1 by 4 or 0.25 units of milk. Now, similarly for farmer 2 he could have made 24 units of milk or 48 units of potatoes.

If farmer 2 devotes all his time for milk production, he makes 24 units. If he spends all his time on potato production, he can have 48 units of potatoes. So, the opportunity cost for 1 unit of milk production is how much amount of potatoes is he giving up to make 1 unit of milk, to make 24 units of milk he is giving up 48 units of potatoes because when he is devoting all his 8 hours into milk production he is having 0 units of potatoes. So, he is giving up 48 units of potatoes.

To make 1 unit of milk he is giving up 48 by 24 is 2 units of potatoes. And similarly, to make 1 unit of potatoes he is giving up 24 by 48 is 0.5 units of milk because to make 48 units of potatoes he is giving up 24 units of milk. So, to make 1 unit of potato, he is giving up 24 by 48 is 0.5 units of milk.

Now, if we make a table of the opportunity cost of both of these farmers. For farmer 1, we have seen that the opportunity cost for milk is 4 units of potatoes. So, the opportunity cost for 1 unit of milk is 4 units of potatoes and the opportunity cost for making 1 unit of potato is 0.25 units of milk, which we are writing here is 0.25 units of milk.

For farmer 2, the opportunity cost for making 1 unit of milk is 2 units of potatoes, 2 units of potatoes here and the opportunity cost for making 1 unit of potato is 0.5 units of milk which we write here 0.5 units of milk. Now, if we look at farmer 1, he has a comparative advantage in producing potatoes because to make 1 unit of potato he needs to give up only 0.25 units of milk whereas, farmer 2 would have to give up 0.5 units of milk.

So, farmer 1 is giving or he is leaving out only 0.25 units of milk for 1 unit of potatoes, whereas farmer 2 has to give up a lot more, double the amount to make 1 unit of potato. So, farmer 1, we can see that he has a comparative advantage for potato production. And similarly, when we talk about milk production farmer 2 will have to give up only 2 units of potatoes for 1 unit of milk, whereas, farmer 1 would have to give up 4 units of potatoes.

Farmer 2 has a comparative advantage when it comes to milk production because he has to give up only 2 units of potatoes whereas, farmer 1 would have to give up 4 units of potatoes. So, farmer 2 has a comparative advantage for milk production. So, here even though farmer 2 was having an absolute advantage in both potato production as well as milk production, what we are observing is that while farmer 2 has a comparative advantage for milk production.

He does not have a comparative advantage for potato production. Farmer 1 has the comparative advantage. Now, in the case of trade, people can go for a trade because they have different comparative advantages. And so, if they go for a trade then it will be for their own mutual advantage. Through trade they can get the product at a cost lower than their own. So, here again what we are

observing is that if somebody can get something from the market at a cost that is lower than his or her own cost of production.

Then it is to their own advantage to take it from the market. Which means that they should go for a trade because through trade they will be able to get these 2 items: milk and potatoes at a cost that is lower than what they would have cost to make at home. So, the farmer 1 who has a comparative advantage for potato production should produce more potato than what he needs and the excess he should sell to the market in exchange for milk.

And the farmer 2, because he has a comparative advantage for milk production should produce an excess of milk than his own requirements and sell the excess in the market in exchange for potatoes. So, trade promotes specialization in activities where people have a comparative advantage.

It is to the advantage of both the parties that they should be making things for which they have a comparative advantage. Never to attempt to make at home, what it will cost them more to make than to buy, in their own interest and in things in which they have some advantage over their neighbours.

So, this maxim from Adam Smith is what actually drives the trade. So, the question is, suppose there is a heart surgeon who also happens to be the fastest typist in the world. Should he type himself or should he hire someone else? And why? Now, the question is whether there is a heart surgeon who has an absolute advantage in both heart surgery as well as in typing because he can type fastest in the whole world. So, he can type faster than any other typist.

But then even though he has an absolute advantage, he would be having a comparative advantage in only one of these two fields. And so, he should not do the typing himself, he should hire someone because he has a comparative advantage in heart surgery and if he has a competitive advantage in heart surgery, he probably does not have a comparative advantage in typing. So, for instance, in one hour if he was doing a heart surgery, say he was earning 10000 rupees, but he could hire a typist for say 100 rupees for an hour.

So, if he is giving up heart surgery or he is giving up 1 hour that he could have given to heart surgery and if he is typing by himself then probably he is not doing prudently. He is not acting rationally. So, trade can make everybody better off because it permits you to do things where you have a comparative advantage.

And for things where somebody else has a comparative advantage you take those goods or services from that person. So, here the heart surgeon should not be doing the typing himself. He should be hiring a typist, even though he has an absolute advantage when it comes to typing.

Now, the next question is what should be the price of trade? That is at what rate should 1 unit of milk be exchanged in the market for potatoes. Now, remember that people were going for trade because it was in their own advantage, they were acting in self-interest, they were not acting in benevolence.

So, nobody is doing a trade to benefit the other party. They are getting into trade because it is to their own advantage. Now, if we talk about the cost of making milk for farmer 1 the cost of making milk is 4 units of potatoes. Now, if somebody says that he should give up 6 units of potatoes for 1 unit of milk would he agree? And probably not. Why? Because he would say that if I can

get a unit of milk from 4 units of potatoes why should I pay 6 units of potatoes?
But if somebody says that ok, we are going to offer you 1 unit of milk for say 3 units of potatoes, then this farmer would think, ok if I made 1 unit of milk myself it would have cost me 4 units of potatoes. But in the market I am getting it for 3 units of potatoes. So, probably it's good for me. Probably I should take up this offer.
Now, similarly when we talk about farmer 2 to make 1 unit of milk he is sacrificing 2 units of potatoes. So, that is the opportunity cost for 1 unit of milk on this farmer 2. Now, if in the market he gets this offer that to get 1 unit of milk you should give up 3 units of potatoes. Now, would this farmer agree?
Well, probably not. Because he would again say that I can make 1 unit of milk myself by just 2 units of potatoes, why should I pay 3? But if he gets an offer of 1 unit of milk from just 1 unit of potatoes he would agree because it is costing him 2 units of potatoes, if he can get it for 1 unit of potatoes he will be happy.
There is a price at which farmer 1 is happy which is if he gets it at anything less than 3, anything less than 4, there is a price at which farmer 2 is happy and is agreeable, if he is getting it for anything that is less than 2. So, there are different prices at which both of these farmers can agree. And similarly, for 1 unit of potato, if farmer 1 can get 1 unit of potato for anything that is less than 0.25 units of milk, he would agree because it is to his advantage.
Similarly, for farmer 2, if he gets 1 unit of potato for anything less than 0.5 units of milk he would agree because it is costing him 0.5 units of milk. If he can get 1 unit of potato from the market at a lesser cost then probably he will go for it. Now, for both the parties to gain from the trade the price must lie in between these 2 opportunity costs.
So, suppose we decide that the price is 3 units of potatoes for 1 unit of milk. So, here 1 unit of milk was costing farmer 1, 4 units of potatoes and farmer 2, 2 units of potato. We take something in between. So, we take 3 units of potatoes for 1 unit of milk. Now, if this happens would these 2 farmers agree to go for a trade as we are interested in knowing?
Now, to understand the impact of trade let us also consider that earlier the farmers were devoting half their time to producing milk and half their time to producing potatoes, that is they were spending 4 hours in producing milk and 4 hours in producing potatoes. So, what was the situation before the trade?
Now, here we are looking at farmer 1 and farmer 2 production and consumption without gain. Now, before these 2 farmers were entering into trade, the amount of milk and the amount of potatoes that they were producing was also the amount that they were consuming because they are not getting anything from outside and they have all what they are producing for themselves. So, the amount of production is equal to the amount of consumption.
Now, for farmer 1, he was devoting 4 hours to make milk and 4 hours to make potatoes. Now, for farmer 1, in 8 hours he could produce 8 units of milk, so in 4 hours he will be producing half of that which is 4 units of milk. And in 8 hours he could have produced 32 units of potatoes, so in 4 hours half of that he would be producing half of 32 which is 16 units of potatoes which is what we are seeing here. If he only makes milk for 4 hours he gets 4 units of milk and in 4 hours he is getting 16 units of potatoes.

Now, in the case of farmer 2, if he devoted 8 hours for milk he made 24 units of milk. Now, if he devoted only 4 hours he would be making half of that which is 24 by 2 is 12 units of milk which is what we are seeing here. In 4 hours he is producing 12 units of milk.

And in 8 hours he could have produced 48 units of potatoes and so, in 4 hours he would be making half of that 24 units. So, this is what we are seeing here. He is making 24 units of potatoes in 4 hours. So, because the amount of production is also equal to the amount of consumption.

So, here farmer 1 is consuming 4 units of milk and 16 units of potatoes, and farmer 2 is consuming 12 units of milk and 24 units of potatoes. Now, here again what we are seeing is that the farmer too has an absolute advantage over both milk and potatoes, and so, he is consuming more milk and he is consuming more potatoes as compared to farmer 1. Now, when they go for trade and in the case of trade the price is decided as 3 units of potatoes for 1 unit of milk.

Now, what happens? Now, suppose farmer 1 because he has a comparative advantage in making potatoes. So, we saw it here, that to make 1 unit of potato he has to give up 0.25 units of milk, whereas farmer 2 would have to give up 0.5 units of milk. So, he has a comparative advantage in the production of potatoes. So, farmer 1 decides that I will spend all my 8 hours making potatoes. So, he is spending all 8 hours for potatoes and so, he has 0 hours for milk.

Now, in 8 hours farmer 1 can produce 32 units of potatoes, so which is what we are seeing here. So, he is producing 32 units of potatoes and 0 units of milk. Now, farmer 2 has a comparative advantage when it comes to milk production. So, in the case of milk, farmer 2 has the cost of 2 units of potatoes for a unit of milk, whereas farmer 1 has 4 units of potatoes for 1 unit of milk. So, farmer 2 has a comparative advantage. Now, in this case, suppose farmer 2 decides that I will spend 6 hours making milk.

And only 2 hours to make potatoes. Now, here again it is important to note that when we are talking about trade we are not saying that you should only be doing things where you have comparative advantages. You can even be doing things where you do not have a comparative advantage because probably the market is not able to supply you with all the things that you need. So, in that case even though it is not a comparative advantage you could be making certain things.

But here what farmer 2 is saying is that because he has a comparative advantage for milk production, he is devoting a larger amount of time for milk production and a very small amount of time for potato production. Now, in 6 hours what is the amount of milk that he will be producing? In 8 hours he makes 24 units of milk.

So, in the case of farmer 2, in 8 hours he makes 24 units of milk which means that in 1 hour he would make 24 by 3 by 8 is 3 units of milk, and in 6 hours he would be making 3 into 6 is 18 units of milk. So, in 6 hours he is making 18 units of milk. And he is only spending 2 hours on potato production.

Now, in this case what we are saying is that when we talk about potato production, farmer 2 in 8 hours could have made 48 units of potatoes. So, in 1 hour he would have made 48 by 8 which is 6 units of potatoes. So, in 2 hours he makes 6 into 2 which is 12 units of potatoes, which is what we are putting here.

So, in 2 hours he is making 12 units of potatoes. So, once they have agreed to go for trade this is the amount of items that these farmers are producing. Farmer 1 is producing 0 units of milk and

32 units of potatoes, farmer 2 is producing 18 units of milk and 12 units of potatoes.
Now, they have decided that the price is 3 units of potatoes for 1 unit of milk. Now, suppose they are going for this trade. So, 1 unit of milk is 3 units of potatoes. So, farmer 1 decides that he will give 15 units of potatoes to farmer 2. So, here because of trade he is giving up 15 units, so we are writing it as minus 15 and farmer 2 is getting 15 units of potatoes. So, we are writing it as plus 15. Now, because the price of potatoes is 3 units of potatoes is 1 unit of milk.
So, 1 unit of potato is 1 by 3 units of milk, 3 units of potatoes is equal to 1 unit of milk which means that 1 unit of potatoes is equal to 1 divided by 3 units of milk. So, 15 units of potatoes is equal to 1 by 3 times 15 which is equal to 5 units of milk. Now, with this price 3 units of potatoes is 1 unit of milk 15 units of potatoes is equivalent to 5 units of milk. So, because farmer 1 was giving 15 units of potatoes to farmer 2, he will be getting 5 units of milk in return.
So, farmer 2 is giving 5 units of milk. So, we are writing it as minus 5 and farmer 1 is getting 5 units of milk which we are writing as plus 5. So, what is the consumption after the trade? Now, for farmer 1 he was not producing any milk, but he is getting 5 units of milk from farmer 2. So, the total unit that he has now is 5 units 0 plus 5. He was producing 32 units of potatoes, he gave up 15 units of potatoes to farmer 2 and so, he is left with 17 units of potatoes.
So, the consumption after trade for farmer 1 is 5 units of milk and 17 units of potatoes. Now, similarly for farmer 2 he was making 18 units of milk, he gave up 5 units to farmer 1 and so, he is left with 13 units of milk. And he was making 12 units of potatoes. He got 15 units from farmer 1, and so now, he has 27 units of potatoes.
Now, what is the gain from trade? Is there any increase in consumption or is there a decrease in consumption? So, earlier without trade farmer 1 was having 4 units of milk after trade he had 5 units of milk. So, there is an addition. So, because of this trade he can consume one extra unit of milk. What about potatoes earlier? He was consuming 16 units of potatoes, now he is consuming 17 units of potatoes which means that the potato consumption has also increased.
So, here farmer 1 is consuming more of milk and more of potatoes because of the trade which means that farmer 1 has added to his well-being he has added to his advantage. Earlier he was consuming less milk and less potatoes, now he is consuming more milk and more potatoes. What about farmer 2? Earlier he was consuming 12 units of milk, now he is consuming 13 units of milk which means that he has an advantage of plus 1. So, he is now consuming more milk.
What about potatoes? Earlier he was consuming 24 units of potatoes, now he is getting 27 units of potatoes to consume. So, now, he has an advantage of plus 3 units. So, he is consuming 3 extra units of potatoes than what he was consuming before the trade. Even in the case of farmer 2, he is now consuming more milk and more potatoes. So, it is adding to his well-being or his welfare as well. So, what we are observing here is that because of trade both farmer 1 and farmer 2 have increased their consumption.
They are now having more resources. So, trade has added to the benefit of both of these parties. Trade has benefited farmer 1 and it has also benefited farmer 2, which means that when we said that the trade increases the welfare of all the parties involved this is an example of that.
Now, how can this trade happen? This trade can occur in 2 ways. There could be a barter system. Now, in the case of a barter system what happens is that both of these parties come to the market

and they exchange these goods with each other. So, for 3 units of potatoes they exchange it for 1 unit of milk. So, both these farmers will go to a market with their produce of potatoes and milk that they want to trade, and there they will be exchanging these two amongst themselves.

The other way is through a market using currency. So, this trade can occur through a barter system or in a market. And in the next module we will have a look at the markets. So, essentially what we are seeing in this lecture is that we began with this thing from Adam Smith that if you can get something cheaply from the market then what it costs you to make at home you should probably get that thing from the market. Because rationally it would be to your own benefit, it would be in your own interest.

And this interest or this sort of a trading helps people to do those things where they have an advantage over their needs. Now, this advantage could be an absolute advantage or a comparative advantage. So, we observed that if we have a society where one good can only be made by one person and the other good can only be made by the second person, then of course, trade is inevitable because if the first person wanted to have access to the second thing he could only get it through by means of trade.

Trade is also very obvious if both the parties have an absolute advantage over something. So, if farmer 1 has an absolute advantage in production of milk and farmer 2 has an absolute advantage in the production of potatoes, then trade becomes obvious. And here we define absolute advantage as the ability to produce a good using fewer inputs than the other producer. So, absolute advantage means that you are requiring less amount of inputs than the other producer probably because you are more efficient.

So, the absolute advantage is talking about efficiency. But then even in cases where you do not have an absolute advantage then to trade makes sense if there is a difference in the comparative advantage. And comparative advantage is the ability to produce a good at a lower opportunity cost than the other producer.

Where opportunity cost is defined as what must be given up to obtain some other item. Now, the concept of comparative advantage is important because even though a person has an absolute advantage in doing one or more of things, he may not be having a comparative advantage over all of them. Because there are some activities that pay at a much greater rate than some other activities. And we looked at the example of a heart surgeon who is also a very good typist.

Now, if he is doing heart surgery he can earn much more per hour than when he can do it when he is typing. So, it makes much more sense for the heart surgeon to devote his time to heart surgery, earn a lot more and then spend a part of it to hire a typist. So, comparative advantage tells us why even though there could be some people who have an absolute advantage in doing many things, they should still go for a trade and trade is still going to make them better off.

Next, we had a look at this case where there is a farmer who has an absolute advantage over 2 goods, both milk production and potato production. And we saw the opportunity cost for both of these farmers for both of these goods. And when we look at the opportunity cost.

We will find that there is some good for which there is a greater comparative advantage for one party than the other party. Now, of course, if both of these farmers were making things at a proportional rate that is if both of these curves were parallel to each other then it is also possible that

there is no party who is having a comparative advantage because say farmer 2 was producing 24 units of milk or 48 units of potatoes and farmer 1 was producing either 8 units of milk or 16 units of potatoes.

So, in that case, the ratio would have been the same for both the farmers 24 by 48 is 0.5 and 8 by 16 is 0.5. And in that case, the opportunity cost for these items would have been the same for both these parties, but then in a real life situation we do not just have 2 parties, we have multiple parties. So, in that case, there would have been some other person who would be having a difference of opportunity cost. So, when we talk about markets we talk about a number of buyers and a number of sellers.

So, which makes trade even more lucrative. But in this case what we observed was that there was a difference in the opportunity cost. So, while farmer 1 was having a comparative advantage for potato production because for 1 unit of potato he was costing him 0.25 units of milk.

Whereas, for farmer 2 it was costing him 0.5 units of milk. So, farmer 1 was having a comparative advantage for production of potatoes. Similarly, farmer 2 was having a comparative advantage for the production of milk because it cost him only 2 units of potatoes whereas, it cost farmer 1 4 units of potatoes.

So, farmer 2 has a comparative advantage for milk production. And in such a case, it is to the benefit of both of them that it is in their own interest to buy things from the market that are available at a cost that is lesser than their own opportunity cost. And so, we can say that they should spend their time doing what is providing them a greater advantage over their neighbours. And here we observed that if they decide at a price that is in between both of these opportunity costs.

In our example they had decided that it should be 3 units of potatoes for 1 unit of milk or in other words 1 by 3 units of milk for 1 unit of potato. So, 1 unit of potatoes is equal to 1 by 3 units of milk which is 0.33 units of milk. Now, we can observe that 3 is between 4 and 2, and 0.33 lies between 0.25 and 0.5. So, if they come to a figure that is in between their opportunity cost then that could be a good price point at which they can trade.

And when they do this trading we observe that they are increasing their consumption of both milk and potatoes. So, there is a gain of trade for both the parties, which is what we had observed in the 10 principles of economics. Trade can make everyone better off. So, that is a short introduction about what is trade and why people go for trade.

And as we will observe in the later lectures, this trade can have a very important ramification for conservation because people might even go for a trade for those items that harm the environment. We will build upon this topic in the later lectures.

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