Infrastructure Economics
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Module – 04
Lecture - 14
Externalities and Infrastructure Development

In this lecture we are going to learn the relationship between Externalities and Infrastructure.

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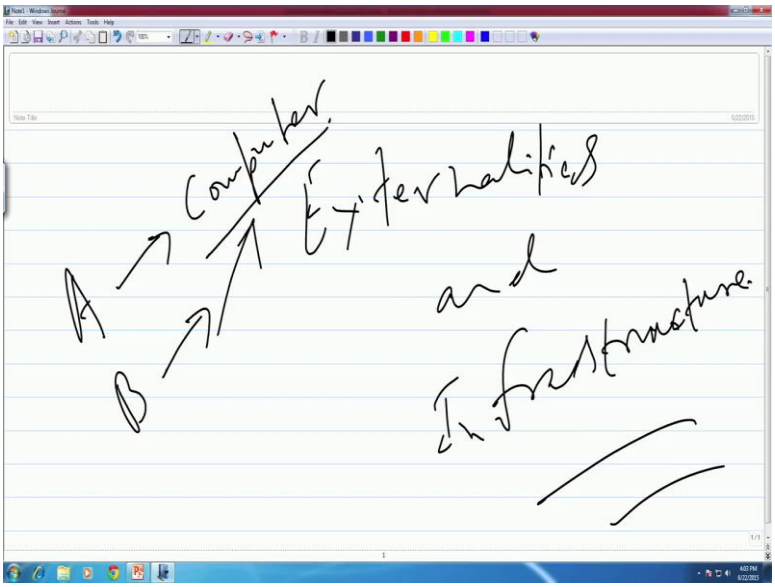

So, we are going to learn the relationship between the externalities and infrastructure. Let me begin with what is basically the meaning of externalities and then we will also learn that how the infrastructure development is again facing the problem of externalities. Let me briefly discuss that… what are the points which we are going to cover today.

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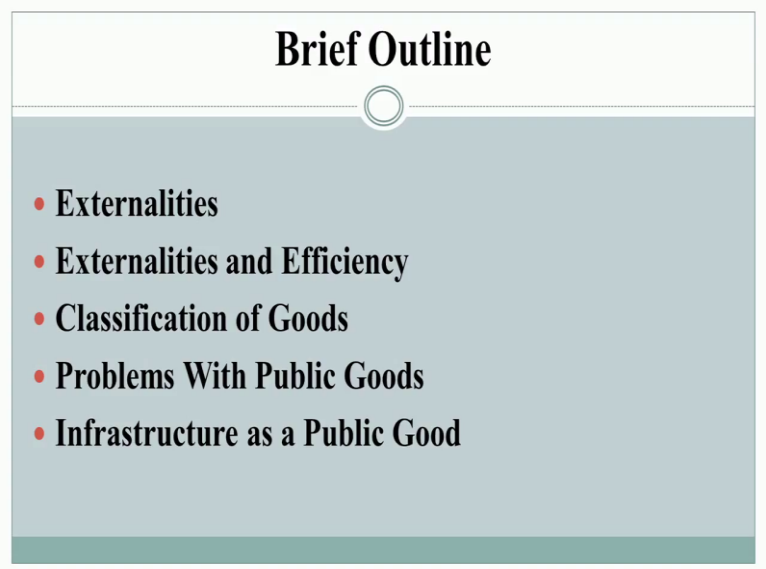

First of all we will learn that what is the meaning of externalities and give the background of different cases and different case studies which we have discussed till now. We will be also discussing some of the other cases of education and health in India and we will be covering not only the two physical infrastructure cases like NHAI and Enron. But we are also discussing the education and health as a part of this discussion, which is basically the part of the social infrastructure development in India.

So, we are finding that the externalities – positive and negative externalities – are basically the part of infrastructure development activities and externalities are not only positive but negative also and it has the relationship with the efficiency in the economy. We'll briefly discuss varieties of goods produced in the economy and all these goods… classification of goods will show that infrastructure comes in a very different type of goods basket where we find that there are linkages of those goods with the externalities and finally we will have a brief discussion on infrastructure as a public goods.

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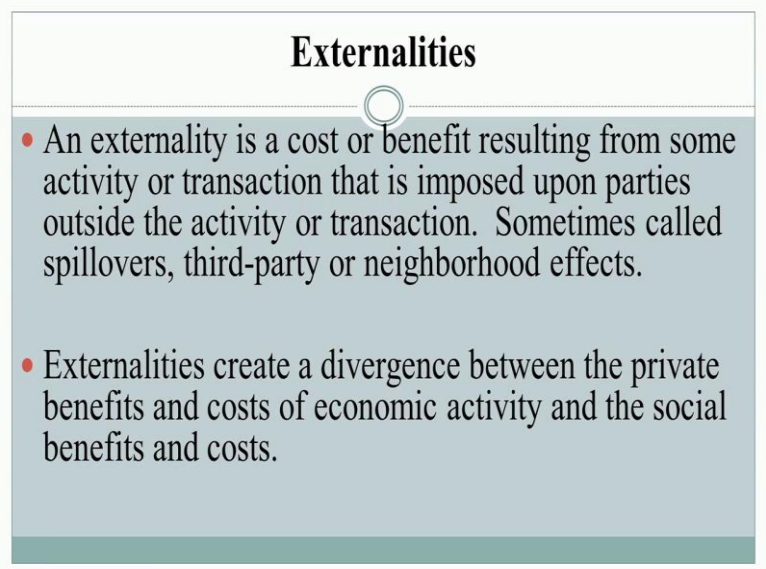

Let me begin with what is basically the externalities. An externalities is a cost or benefit resulting from some activity or transaction that is imposed upon parties outside the activity or transaction. Sometime this is also called as the 'spillover effects' or 'third party' or 'neighborhood effects'. So, externalities create a divergence between the private benefits and costs of economic activity and the social benefits and cost.

Let me give you… let me also discuss a very live example that if a particular industry is throwing garbage in your city. It is true that industry is producing something for some specific consumer who wish to buy the products. So, in the production and consumption may be different set of consumers are involved to consume the product which that industries producing. But at the same time when the industry is throwing out those byproducts in the city or dumping those byproduct somewhere in the middle of the city, the impact is not only on the people who are basically consuming those products, but impact is equally on all the citizens passing through that particular root.

And this shows that there is a externalities, there is a impact on the third parties which has not really being involved in the production process or consumption process. But the impact is on the outside party which has not been really participating either in the production or in consumption. So, this particular example gives you the idea of how externality works. So, externality… this particular activities is the negative externalities, because the garbage thrown in the city pollutes the city and it creates a health hazard, it

creates problem for the kids, problems for all the citizens of that particular city and this is not really an example of the positive externality. It is an example of negative externality because the impact is very much negative on the third party.

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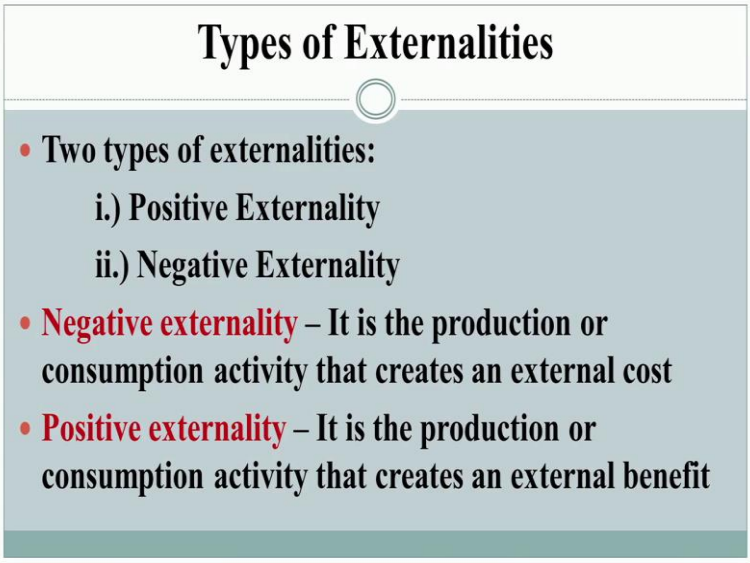

So, externalities are… for the benefit of understanding, externalities are divided in two parts – positive externalities and negative externalities. Negative externalities are those activity that creates an external cost on the third party. It is the production or consumption activity that creates an external cost. So, a person is smoking cigarette is having the benefit of the smoking project because somebody use to smoke they cannot survive without smoking cigarettes. But at the same time the smoker is not only getting the benefit of that smoking but that also harms the people nearby. So, the external cost is paid by the other non-smokers also, even if they are sitting nearby the smokers. So, this is the example of the consumption activity which has the impact on the third party; the party which were not involved in the consumption of the cigarettes, but they are also affected by the consuming of or the smoking of the cigarette by another person.

This is the example of negative externalities through the consumption. The negative externalities through the production I have already discussed that is if the industries trying some garbage in the city, there will be certainly some negative impact on the people. It will be the activity of polluting the city. But there are certain positive

externalities also. Infrastructure development is basically having the positive externalities in the society.

Because whosoever is getting the benefit whether they are paying or not, whether they are directly involved in the production of those infrastructure are not, everybody gets the benefit whether the infrastructure developed in a particular city. But the people coming from other city also, people coming from the other states also, they are also getting the equal benefit of such infrastructure which is available in the city. If the street light is available it is available for all. So that is the positive externalities. If a good park is available, it is good for citizens of that particular place and the citizens outside that particular city or town. So, there are many positive externalities also which has been noticed by different economists and varieties of books available… Microeconomics book is discussing these particular externalities as a part of the discussion. So one must see… you can just have a look on those discussions available in Samuelson or in many other books on economics, where varieties of example you will be able to learn.

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So, there are social marginal benefits in cost involved when the two parties are involved in production and consumption. So, social marginal benefits are defined as the benefits… marginal external benefits associated with any activity. Marginal private benefits, marginal external benefits associated with any activity. But, the social marginal cost are defined as the cost of an activity expressed as the sum of marginal external cost or

marginal private cost. A society is always having an optimum condition of production or you can say optimum condition of the market activity, when the social marginal cost are equal to the social marginal benefit.

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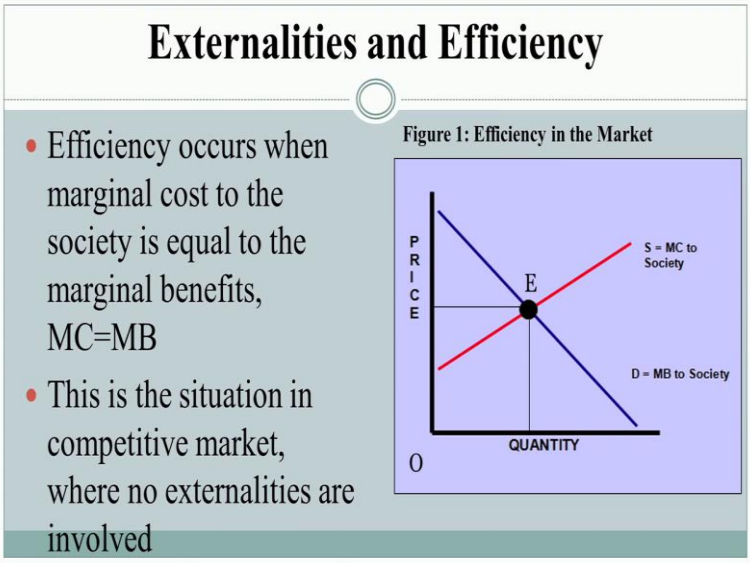

In this diagram one can see that if externalities are occurs when marginal cost to the society is equal to the marginal benefits, if externalities occurs then that really affects the equilibrium condition in the market. Why? Because, if there is a huge negative externalities, producers are not really producing the product efficiently… that says the producers are not producing the product efficiently, because there is a high level of marginal social cost involved in the production.

So, this is the situation in competitive market, in this particular diagram where we have the equilibrium at point E, where the marginal cost to the society is equal to the marginal benefits of the society. And that is possible only when market is fully competitive and there isn't any monopolistic activity going on, there isn't any free-riding going on, where the control of the production and the distribution is so good that nobody is allowed to really get huge marginal benefit. But the benefit of the society and the cost of the society is close to each other.

But there are cases of negative externalities where the fact is that world has seen that such equilibrium which we have discussed in pervious diagram is not really attendable always in the society. So, societies always facing the problem of negative externalities,

economy has always the different between the marginal social cost and marginal social benefit.

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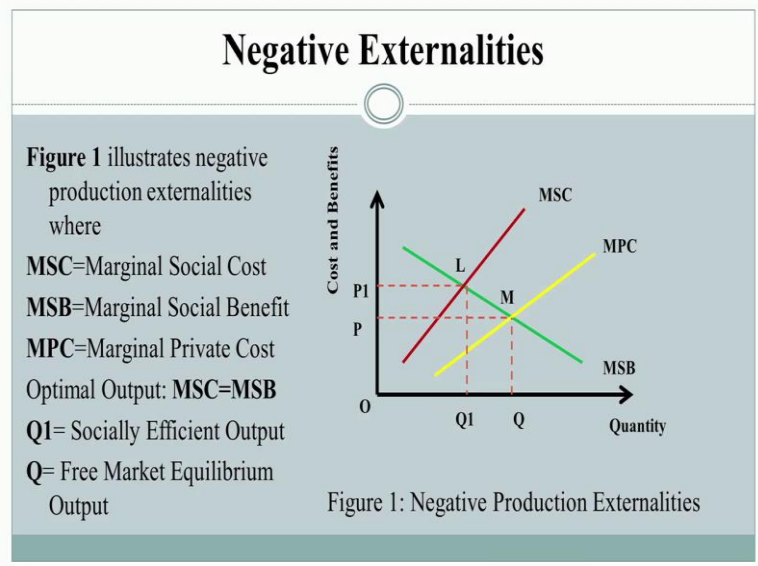

In this diagram the Q 1 quantity produced in this particular example is the society's optimum efficient output condition and we find out that Q is the free market equilibrium output. If you are really allowing the private parties to produce they will not be able to produce on a quantity that will give them less marginal benefits. But they will try to have the higher benefits for achieving the more costly activities. As we have seen this case, if society is producing q output then society is having the difference between the marginal benefit and that different in the marginal benefits is difference between L and M in this particular diagram.

So… but society is not really… the producers are not really satisfied with the production of Q 1, because at Q 1 production society has to pay the higher price that is the P 1 price. But, the fact is that on Q 1 price society is having marginal social cost which is higher then the marginal private cost. So, the social cost is higher than the marginal private cost in this example. If they really think for the free market equilibrium output they have to really produce the price level from P 1 to P and at P we are finding that the society's benefit is more marginal social benefit is more and then it is reaching to the level of M.

So, the new interaction of the marginal private cost and the marginal social benefit is at the level of M. So, shifting from L to M in case of marginal social benefit is only

possible, when the free market equilibrium output is available. But, the fact is that when you allow free market equilibrium when you allow more and more private parties to produce as per there capacity to produce it is a fact that they will produce, price will be also less. But the fact is lots of negative externalities are going to also catch the production process and ultimately in such cases there are large numbers of marginal social cost involved.

So, the optimum conditions with socially efficient output is not really equal to the free market equilibrium output in this example. So, if society has to really think for socially efficient output they have to pay little higher price. The production will be little costlier and the price will be little higher. Because they have to take care of the pollution, they have to take care of the negative externalities, but society has… if the producer is free to choose their own path without taking care of the negative externalities price may be little less, marginal social benefits may be very high, but that production will not be at the socially efficient output level.

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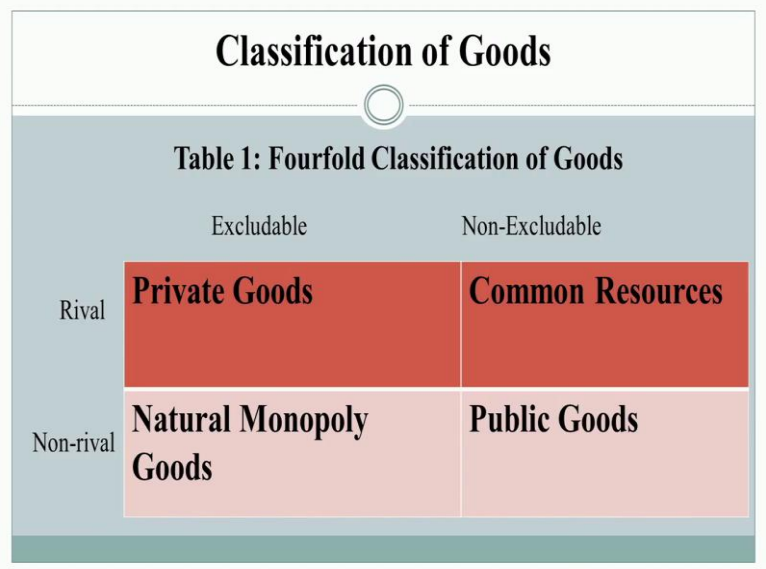

Let me also see the fourfold classification of goods – the public goods, the private goods, common resources, natural monopoly goods and public goods.

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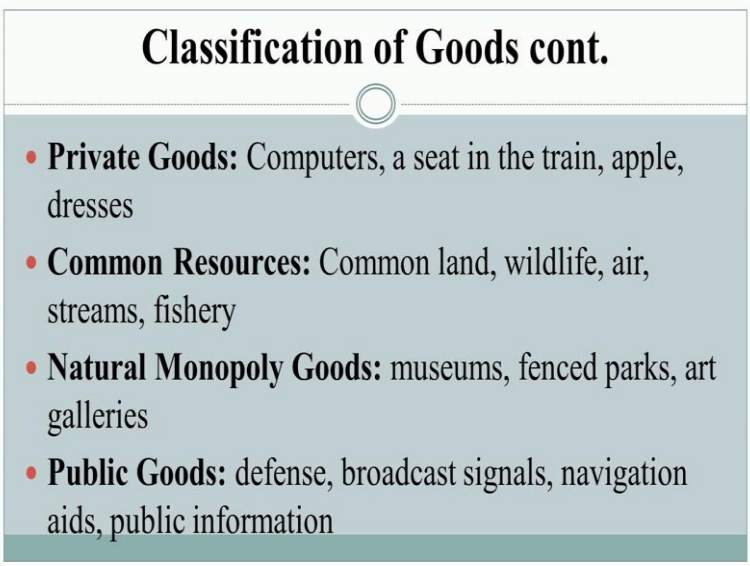

Before discussing this matrix one can also see the classification of goods in economic principles private goods are basically the computers or a seat in the train or the dress material or an apple or anything, any item which is eatable and common items. So, private goods are basically those goods, which have two distinct feature and that is the rivalry in consumption and excludability. So, rivalry in consumption means when the person when A is consuming it B will not be able to consume. So, suppose if A is consuming a particular item and B is also trying to consume that particular item… suppose if A is purchasing a computer or having a computer, A has paid for this particular computer, B will not be able to really have that particular computer… that brand of the computer and on the price which A has already paid for it. Because the moment A has paid for that particular computer it is the property of A and the product consumed by A is not the product which will be excluded for B or C or D. An apple consumed by A is not the apple consumed… to be consumed by B also, because A has already consumed and finished it. So, the private consumption is different; private goods consumption is different from the public goods consumption and in this example we can find out that… we can simplify find out here that the consumption of a particular private goods or having the rivalry and that has basically the excludability.

Common resources – In the next example which you can see here: the common land, wildlife, air, fishery. These common resources are having the… it is basically different from the private goods because it has the non-excludability. But there are rivalry in

consumption also for the common goods. Again the natural monopoly goods in the next example which we can see the museum or a park or the art gallery where we are again finding that these natural monopoly goods are non-rival but there are excludability involved in the consumption.

At the same time public goods, public goods are non-rival and non-excludable, such as some examples are defense. If defense is for a citizen in the north India, the defense is equally provided to the citizen of south India, because you cannot have the distinction in the country's defense. Broadcast signals if it is available to one, it is available to other subscribers in that particular region. Public information is not the item which may be excludable in nature. So, if the public information to one person it is available to other person also. So, we can find out that these classification of goods are important here to understand because when we are discussing the topic infrastructure there are so many things which one can really discuss here.

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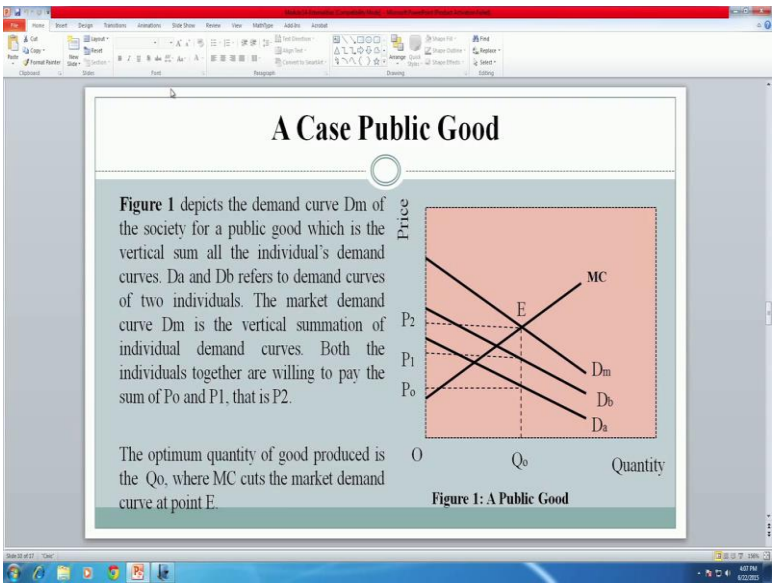

In this diagram also we are finding that the demand for public goods by different individuals in this particular diagram Da or Db is club together as the market demand, which is Dm and this demand is intersecting the marginal cost of the production line and the equilibrium line is that E point. So, the optimum quantity of goods produced in this particular diagram is Q 0, where the MC cuts the market demand curve at point E.

So, we can say here that the production of the public goods are subject to the non-excludability and non-rivalness in the consumption and now this point is valid when we are discussing the infrastructure and it's relationship, infrastructure as a public goods.

So, let me also discuss little bit about what is basically market failure. Because public goods are one of the points for the discussion on market failure. So market mechanism provides better and efficient outcome prices and quantities produced… market prices and quantities produced are demand and supply driven.

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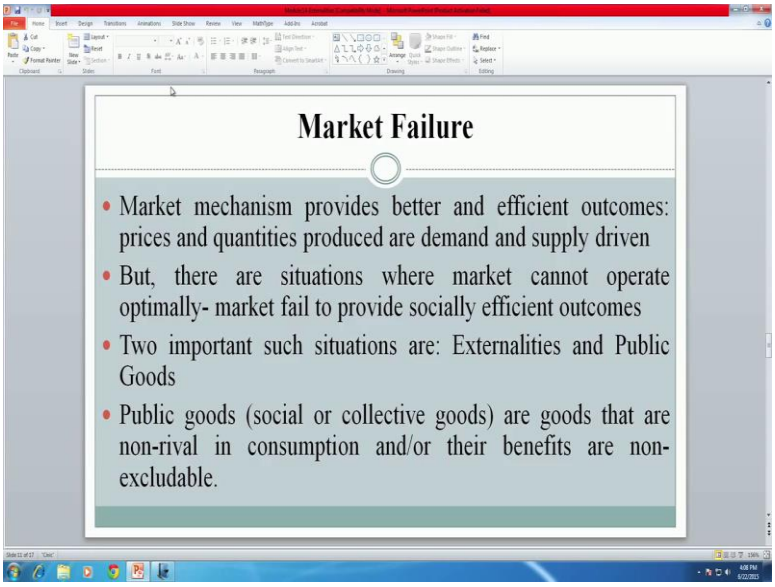

So… but there are situations where market cannot operate optimally and market fails to provide socially efficient outcomes as in one of the diagram we have seen. So, two important such situations are externalities and public goods, where the market is unable to provide the socially outcome or efficient outcomes. So, how public goods? Because public goods are the goods that are non-rival in consumption and their benefits are non-excludable.

So, if the matter of public goods comes there are three points like the non-excludability which has the meaning that no easy way to prevent someone from consumption of goods and services.

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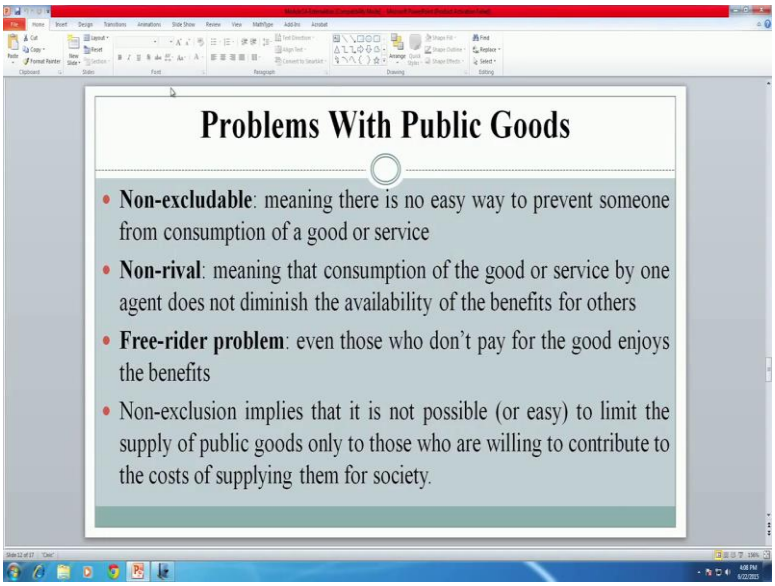

And non-rival means the consumption of goods are services by one agent does not diminish the availability of the benefits for others. So, the problem with pubic goods are the problem of the free riding – even those who do not pay for the goods enjoy the benefits. So, if the flyovers is available… flyovers cannot be excludable for few people whether the flyovers was made only for a taking care of the population of a particular city, we cannot really stop using that flyover by the people who are coming from the other city.

So, non-exclusion implies that it is not possible to limit the supply of the public goods only to those who are willing to contribute to the cost of supplying them for the society, but we have to also allow others to really enjoy the benefits of public goods.

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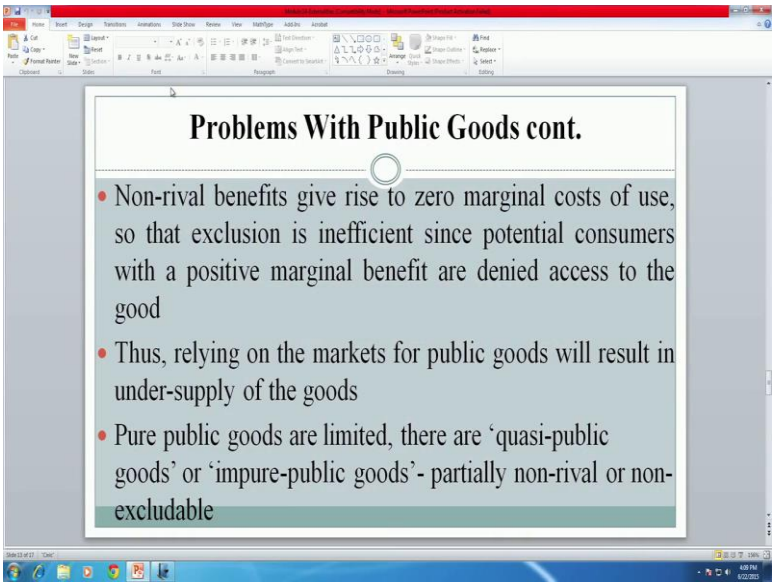

So, other problems with the public goods are non-rival benefits give rise to the zero marginal costs of use. So, that exclusion is inefficient since potential consumers with positive marginal benefits are denied access to the goods. Thus relying on the markets for public goods will result in under supply of the goods. So, if free writing problems are going on and non rival benefits are being taken… so rise to zero marginal costs of use because even if we are adding the consumers, we are not really having any marginal cost of production of such items.

Thus, relying on the markets for public goods will result in under supply of the goods. Pure public goods are limited. There are quasi public goods or impure public goods, partially non-rival or non-excludable in nature. So, let me now interconnect the public goods with infrastructure.

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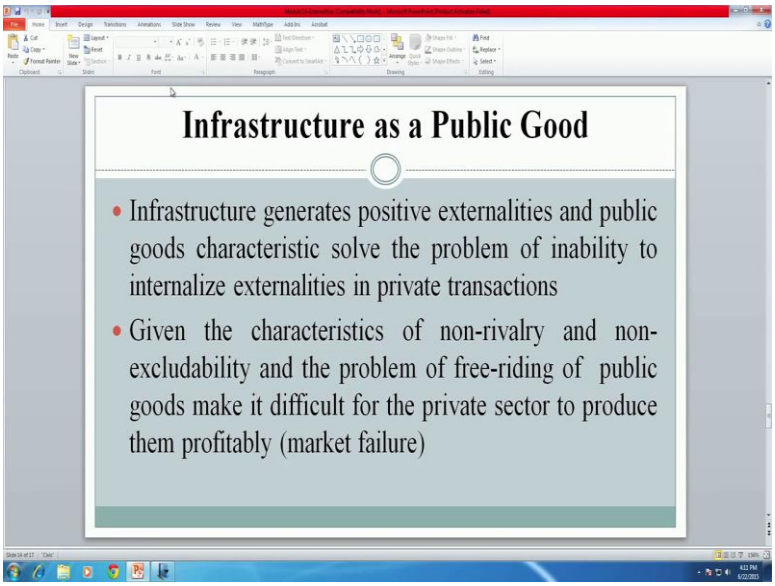

So, infrastructure generates positive externalities and public goods characteristics solve the problem of inability to internalize externalities in private transactions. Given the characteristics of non-rivalry and non-excludability and the problems of free riding of public goods which makes it difficult for the private sector to produce them profitably and then market fails basically. We have seen many developing country including India that there is a free riding problem related with the various infrastructure developed in the country.

Even electricity which is one of the very costly affair to produce we are finding that there is a free writing problem in electricity consumption in many developing country. So, in this situation when we have large number of externalities involved in the production, in the consumption or during the production, we cannot really say that infrastructure facilities developed by a private parties will have the possibilities of will payment system. So, there is a non-payment system for the infrastructure developed and that is the big challenge of for many BOT (Build Operate Transfer) and Build Operate Owned projects especially for BOT when we are allowing the firms to produce… to have the infrastructure ready and to have the license fee collected for more than 30 years.

We find out that it is not so easy for them to collect the fees are the charges for using those infrastructures, because of the given nature of the non-rivalry and non excludability of the infrastructure goods. So, broadband highways, health education, and some other

infrastructure facilities cannot be left for the market due to the public goods in nature. So, very difficult conditions for the government, for the policy makers, for the regulators that what method they should adopt to really have good system of catching those free riders. Payment on cost basis often lead to the under-consumption of infrastructure, consumers have to make rational decision of how much to consume based on the cost.

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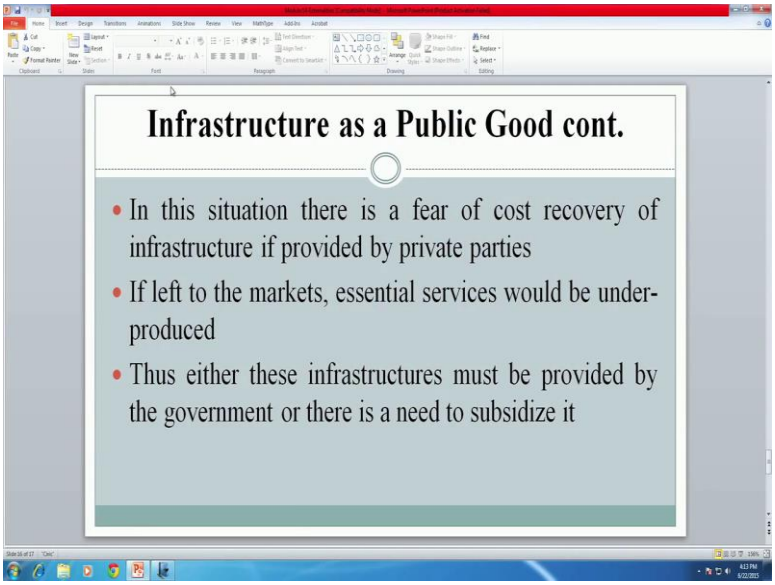

So, these are the points available with the infrastructure as a public goods. In this situation there is fear of cost recovery of infrastructure if provided by the private parties. If it is only in the private hands then private parties are really concerned about how to get the benefit as soon as possible and then they are charging the huge price for the facilities provided and when they have huge prices as charge then there is a question of again non-users of those facilities.

So, ultimate benefit of infrastructure development is not really practiced when we are really stopping somebody to use that. So, if left to the markets essential services would be under-produced or may be under-utilized. Thus either these infrastructures must be provided by the government or there is a need to subsidize it. I think this discussion is briefing the inter-linkages between the infrastructure and the market failure, infrastructure as a public goods.

And through this discussion we are basically learning that how infrastructure development, even infrastructures are developed or infrastructure are being… facing a

challenges of free riding, because infrastructure… varieties of infrastructure is having two different characteristics of the public goods and that is basically the non-rival and non-excludability.

Thank you.