Infrastructure Economics
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Module – 02
Lecture - 07
Infrastructure and Economic Growth

We are starting a new discussion on Infrastructure and Economic Growth in the module 7. Till now we have understood that how infrastructure is one of the prominent facilitator for economic growth. We are going to have some more discussion on how infrastructure is really boosting the economic growth.

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So, as a brief outline of this presentation you can just see here, we will discuss the economic growth. What are the different measures of economic growth? How to measure the economic growth? Production function and economic growth and then, how infrastructure is influencing the entire process of economic growth.

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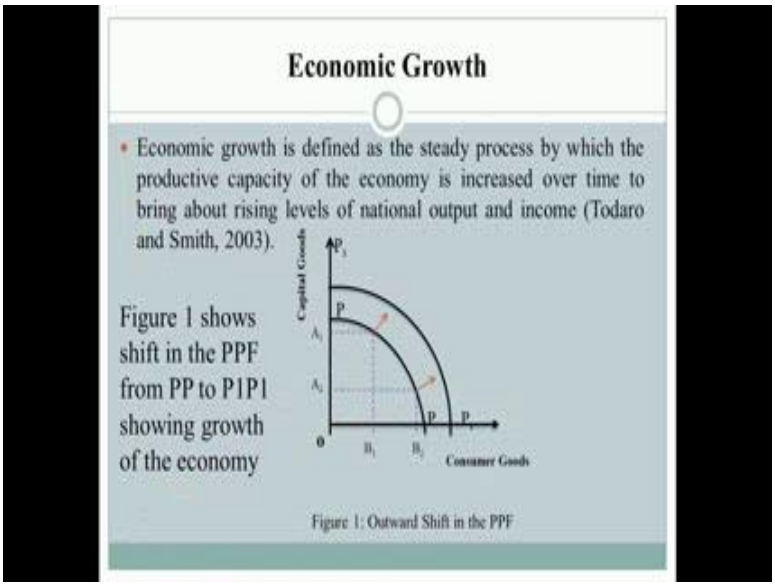

So, let me begin with this production possibility curve and through this production possibility curve, we can also link the economic growth and how infrastructure is really influencing the shift of this production possibility curve. So, economic growth is basically defined as the process by which the productive capacity of the economy is increased over the time and how it basically brings the new level or maybe the rising level of national output and national income.

So, production possibility curve or production possibility frontier PPF or PPC, this shows that how economic growth process is basically indicated in the shift in the rightward side. Here, we can find out that if the production possibility frontier… Let me also explain briefly, what is production possibility frontier. Every country is having limited resources and a country has to design the production in a way, so that they can get the maximum advantage of exploiting those resources.

So, once a country is involve in production of a particular item, countries specialization and countries factors of production will be involved in that and ultimately they have to leave the other part of the production, because if you have the limited resources, you cannot have unlimited production from the limited resources. So, there is a opportunity cost involve in the production, a country is producing computer. Because, a country is specialized in the production of computer, because a country has a better resource

allocation and better resource outcome from the production of computer compared to the food grain.

So, like that if the production possibility frontier has to shift, if the country has to really look for more production, a country cannot stick to the similar production possibility curve on the same production possibility frontier. If a country moves on a particular production possibility frontier, let me also explain this on the board.

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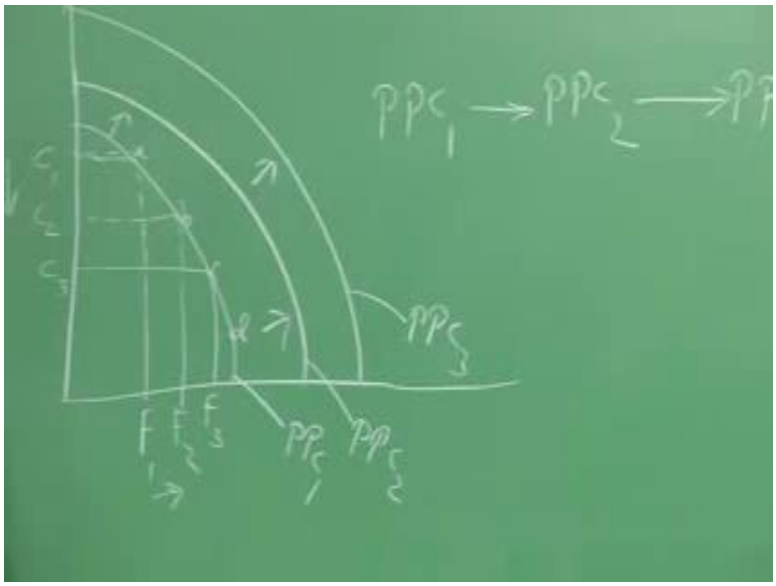

If the country is really on the same production possibility frontier moving from here to here, here to here, this is only called as the movement in the production possibility frontier. While, if a country is really shifting from the previous production possibility frontier to the new production possibility frontier, this is not the movement a, b, c and d. If the country is producing c 1 computer and f 1 food grain and then, country is moving from c 1 to c 2 and f 1 to f 2, we are finding here the computer production is declining and the production of food grain is increasing.

But, this particular change is basically the movement on the same production possibility curve. But, when country has to grow faster, a country cannot really continue on the same production possibility curve, they have to move further on the different production possibility curve. And more resources if they are really a country will further move, further shift from the previous level of production possibility curve to the new level of production possibility curve.

So, from PPC 1 to PPC 2 to PPC 3 this is moving from PPC 1 to PPC 2 and from this level to PPC 3 is called the shift in the production possibility frontier. So, what I am going to basically explain here is, this is not possible as long as the new infrastructure is not added in the economy. So, several examples from many developed country, developing countries shows that, more they have invested in infrastructure, more they had real outcome coming from the production.

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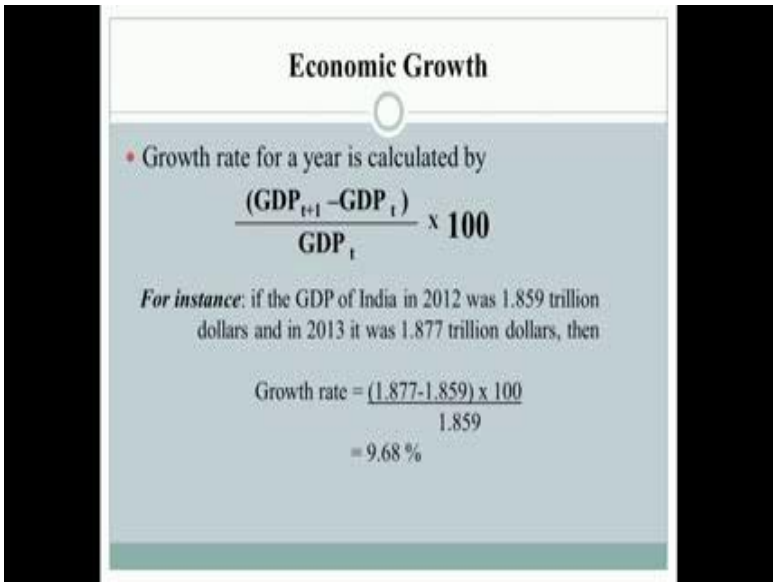

So, production possibility frontier really makes a change in the economic growth and that economic growth may be also calculated with an equation. So, here you can find out that the gross domestic product, $Gr = \frac{GDPt+1-GDPt}{GDPt} x100$, we are getting the growth rate.

So, in this example if the GDP of India is in 2012 was 1.859 trillion dollar and in 2013, if it was 1.877 trillion dollar, then the growth rate is 9.68 percent, because $Gr = \frac{GDPt+1-GDPt}{GDPt} x100$ is the growth rate which we have calculated here.

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So, there are various ways of measuring the economic growth, GDP or GNP Gross Domestic Product and Gross National Product is one of the way to calculate the economic growth. GDP includes the production of all the sectors in a specific year, as we are aware that economy is divided in three different sectors, primary, secondary and tertiary, agricultural and allied, industrial and service sector. And the contribution of all these sectors together is the GDP of a particular economy.

GNP do includes the contribution of our factors of production not only within the country, but also the factors of production outside the country. And by economist to find out that how we are moving ahead from the past. GNP per capita or per capita income is again one of the other measurement of, other way of measuring the economic growth. Here, we do calculate the gross national product of a country divided by the population.

These days many countries especially the Nordic nations has started calculating Netherland, Denmark and Sweden and other economies, they have also started calculating the green GNP, green Gross National Product, because they are also calculating the environmental damage and cost during the production. Some of the economy is basically calculating the human development index and they are finding, a little difficult that if economic growth process is really fast. Then, what is basically the impact on the human development indicators.

And some of the economy, one of the most interesting economy in the world today is the Bhutan, which calculates the gross national happiness. It is not the gross national product, but they are basically having a different way of calculating their happiness and that is the way they calculates their economic growth.

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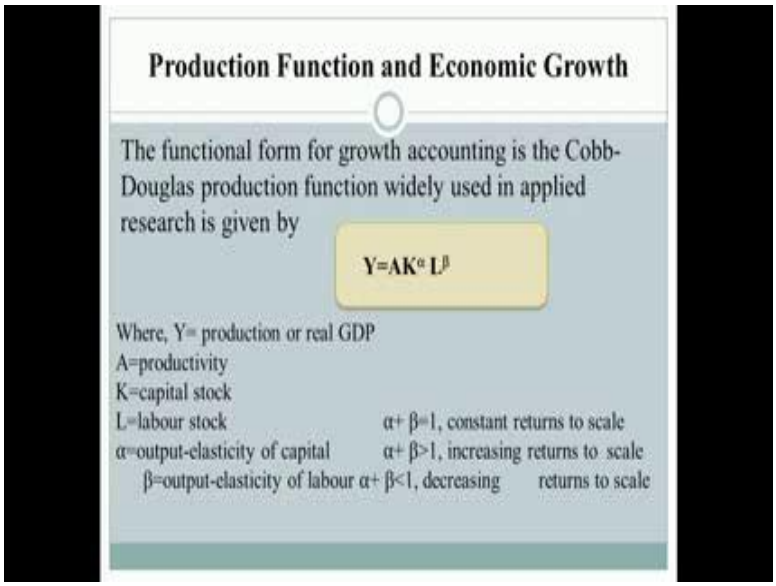

So, with this background, when we say that economic growth is basically influencing the production, the functional form for growth accounting is the Cobb Douglas production function widely used in the applied research, which is ($Y = AK^{\alpha}L^{\beta}$) where Y is the production of real GDP, A is the productivity, K is the capital stock, L is the labour stock, alpha is the output elasticity of capital, where the beta is the output elasticity of labour.

So, if $\alpha+\beta=1$, it means that there is a constant returns to scale, if $\alpha+\beta>1$, then it means that it is increasing returns to scale, if $\alpha+\beta<1$, it means that there is a decreasing returns to scale. So, this is also one of the way to find out, whether the, whatever inputs are used in the production, whether it has the constant return, increasing returns or decreasing returns.

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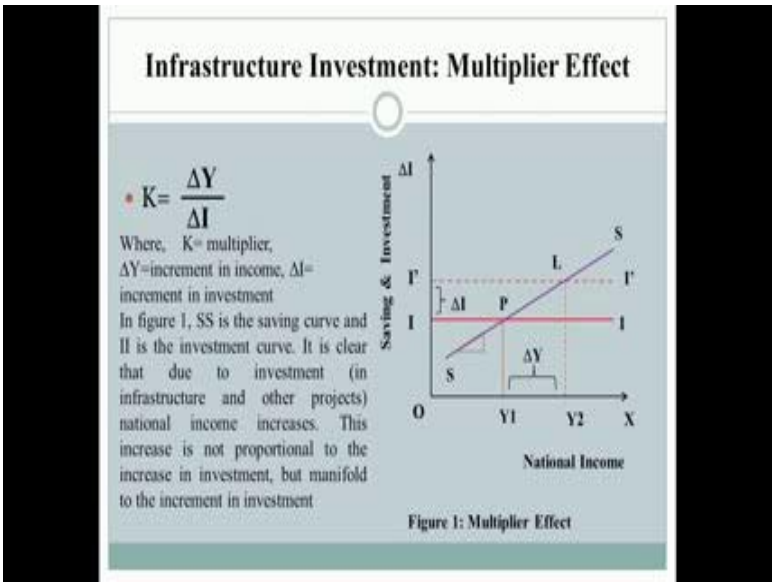

Infrastructure investment has, certainly it has the impact on the output. Here in this diagram, you can find out that the multiplier $K = \Delta Y/\Delta I$. And here we are finding that there are two curves, one is the SS curve is the savings curve and another one is basically the curve, II curve and we find out that any small change in the investment curve, which is horizontal to the O X-axis. We find out that a small change delta I reflected in the change in the Y and the output has shift from Y 1 to Y 2.

So, this change is possible because of the change in the investment and if economy is having the change in the investment especially in the infrastructure sector, if one can see the statistical pattern after previous growth in many country. One can find out that due to the huge investment in road constructions, buildings, bridges, hospitals, education, other physical infrastructure, flyovers, metro, rail track, air facility, we are finding that the entire mobility of the factors in the production process is very high.

Because, if you have large number of investment, if you have infrastructure which is always long term gain for the economy, economy which enjoy the current infrastructure today. If they are having a additional infrastructure every year coming up, economy is in the position to have more mobility of the factors, whether it is labour or whether it is raw material are not only in terms of mobility of the factors, but also in terms of the mobility of the final product from one place to other place.

And that really make the change in the output, the output is nothing except the change in the factors of productions, capability to satisfy the final consumer. So, if the raw materials are only raw materials, if the food grain is only food grain, if the raw steel is only raw steel, then you are not going to get a proper return in the production process.

But, the moment you are making raw steel into a new item, the moment you are making food grain into a new item, a processed food product, you are achieving a different gain in the economic scale. And, that is possible only through the investment in the machines, investments in the infrastructure, investment in the roads, investment in the transportation facility and that is, I can simply say that is the magical effect in the production process.

Because, that magic is start happening when the economy is constantly investing in such items and that investment is not going to give you the return only for a year. But, that investment is going to give you return for years and years and that is the benefit of the multiplier effect of the investment and which is reflected in this particular diagram.

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So, infrastructure investment influence a country's absolute and comparative advantage by mitigating the constraints of factor endowments and promoting intra and inter regional integration. So, infrastructure is not only affecting the aggregate output, but it is also affecting the aggregate output in the sense that it gets the benefit, it provides the benefits to the consumer as well as it provides benefits to the supplier.

So, any shortage in the economy or any surplus in the economy, most of the economy today finds the problem like shortage or surplus, both are equally a disequilibrium condition in the economic development. And that is the issue of the discussion for everybody that some of the economies having certain surplus resources, some of the economies having certain scarcity of the resources. Similarly, some of the economies having surplus food, some of the economies having scarcity of the food, some of the economies having surplus technical item, but some of the economies really starving for a new technology.

So, in this situation when you have a scarcity and surplus, infrastructure do try to bridge this gap between the haves and haves not and because it basically motivates the economy to have more mobility of the factors from one part to other part of the country from one world to other world. And if that is possible then at the sectoral contribution to the GDP formation and as an additional input in the production process of other sectors are really increasing by raising total factor productivity by reducing transaction and other cost thus allowing a more efficient use of conventional productive inputs.

Infrastructure can be considered as a complementary factor for economic growth, because the moment a firm is getting the ready infrastructure, a firm is not worried for their production. But, the moment a firm is not having that ready infrastructure even if form is investing very high at a very high level, but the firm is really worried for what type of complementary infrastructure we will receive and how we will move the production from one part to other part.

So, that is one of the challenge for many underdeveloped states in India today. Industry is ready to invest, but at the same time, industry is finding it very difficult that even if we will invest, what will be the mobility of the factors of production? What will be mobility of the final product? How we will reach to the consumer and with these questions they really got a different message that it is better to stop only in the developed states and better not to go to the underdeveloped states.

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So, how infrastructure and economic growth, how infrastructure influence the economic growth? Economic theory identifies four channels through which infrastructure can have a positive impact on economic growth one by one. One can see here the power and transport is really making a u-turn in the production process and it really contributes in a very positive direction for the growth of economy.

At the same time entire capital formation is not possible through the infrastructure support, because capital development and capital accumulation is only possible when the factors are mobile, when the factors of productions are static they cannot really contribute in the capital formation.

At the same time if you have to really, stimulate the aggregate demand process as we have seen in Keynesian argument that aggregate demand is the demand, which makes a change in the economy. So, it really have a very positive impact on the resource mobilization. So, in such a sense if you really need a aggregate demand level to be stimulated, you cannot really work on the previous infrastructure, but you have to add, you have to supplement, you have to complement the new infrastructure for the economy.

At the same time there are spillover effects and that induce investment in other sectors, investment in infrastructure relative to agriculture is really having more productivity in agriculture that really going to have a support for the agro based industry. The

production in agro based industry is again going to create an avenue for other bigger industries and at the same time there is more inter linkages of the economy and that is only possible through the more support from the infrastructure.

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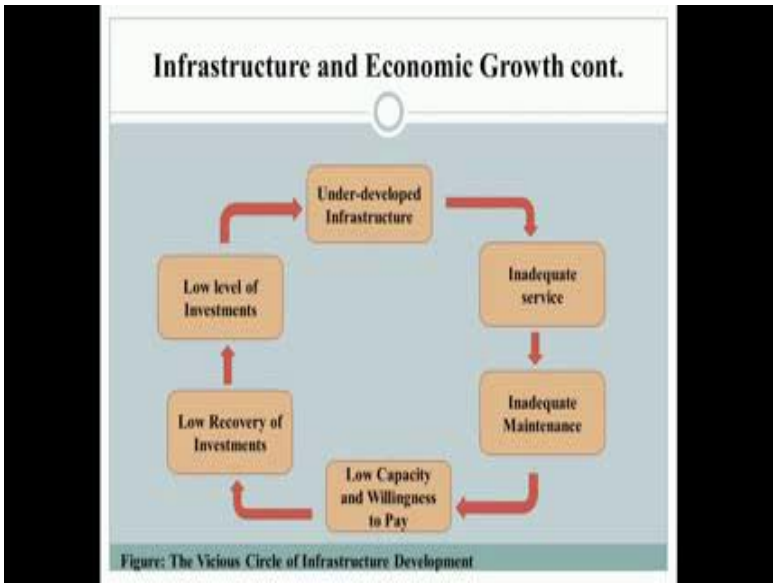

One can see here that if a country is having under-developed level of infrastructure that under-developed level of infrastructure is again creating a different circle and that circle is not going to really give you a better result in terms of economic growth. Here, in this diagram one can see that if you have the under-developed infrastructure stage then the economy is not in the position to provide you a better service facility. So, you have providing economy is providing the inadequate services and if you are having the inadequate services provided in the economy, you are also not going to have a full-fledged maintenance of those infrastructures.

So, in such a situation if you have very weak infrastructure, if transport services are very poor, nobody wish to pay for that everybody wish to pay for the better infrastructure facility, nobody wish to pay for the worst infrastructure facility. So, you have low capacity and willingness to pay when you have low level of maintenance of infrastructure due to the very poor level of infrastructure services or inadequate services.

So, if you have low capacity to pay, the recovery on the investment is again very low and again if you have the low returns on the investment, you are again going to have the low level of investments. And this again low level of investment in infrastructure is making

you very uncertain about a proper development of infrastructure. So, this is the vicious circle of the poor infrastructure, where you are not really having a better facility. You are not really having a better infrastructure services and that makes you always put in the same vicious circle of this infrastructure backwardness and that infrastructure backwardness leads you to become under-developed for many years.

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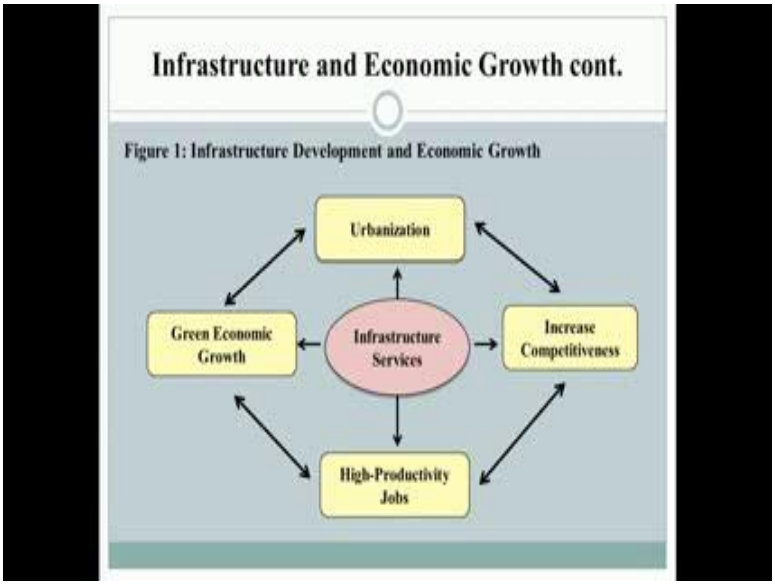

Here, one can also see that if infrastructure services are improved it has the impact on other aspects also. Better infrastructure services improves the urban living conditions and better urbanization, at the same time if infrastructure services are well enough then you are really having the increasing competitiveness in the market, it means that you have high productivity job in the market.

Because, if you have the competition in the market people will try to invest in your market, if you do not have high competitiveness in your market, if you have natural monopoly in the market or if you have monopoly, because of some other reason, because of the government policy or because of the illegal activities or market failure.

Then, in that case, you do not have high productivity jobs, but you have the jobs for only selective sectors and you are not really nurturing the competitiveness in the market. So, ultimately you are inviting a very different level of market failure. So, but if you have a better infrastructure services available in the city better educational situation, better

health service, better water conditions, better sanitations, you are much advantageous position compared to other countries.

Because, you are having a much green economic growth model compared to the countries, where you are having more growth, which is based on the negative externalities. So, here we can find out that infrastructure development and economic growth is interlinked, because so many hidden benefits is interlinked and that comes only when you have better infrastructure developed and better infrastructure served to the society.

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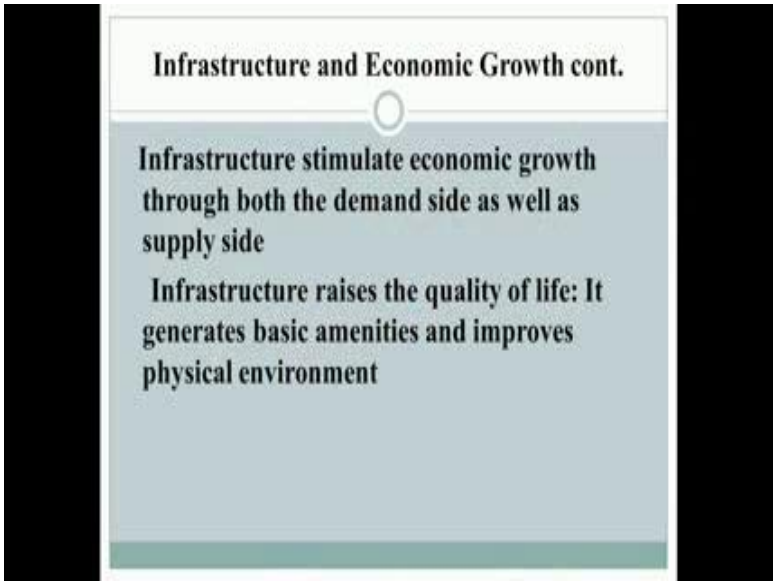

So, to sum up infrastructure stimulates the economic growth through both demand side as well as the supply side. Because, as a producer I am ready to get the raw material on low cost, I am ready to have production on time, because of the availability of electricity and because of availability of other inputs of the production. But, at a consumer also not only as a supplier I am getting the benefits of infrastructure, but as a consumer also. I am going to get the fresh material; I am going to get a very well packed material on time due to the infrastructure support.

So, as a consumer, as a supplier, as a producer, as a last consumer, infrastructure helps in getting the product as a factor of production a labor is more mobile, as a factor of production capital is more mobile, if you have ready infrastructure and well developed infrastructure. At the same time infrastructure raises the quality of life, a better flyover

system, a better metro helps the population to avoid the traffic jam, to avoid the running in the pollution. And it generates basic facilities and improves the physical environment of the country.

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Infrastructure contributes to economic growth through reduction in the cost of production as we have constantly discussing in last few module that how the cost of production is declining. Because, if you have availability of the raw materials from different sources due to the infrastructure support and that to on the low cost, if you have the electricity provided by the state or provided by the economy on a very low cost, you do not have to depend on your own source of electricity generation and buying the electricity from other sources.

You certainly have the possibility to continue with the low cost of production. So, that basically leads you to economic growth a producer cannot grow faster, if the producers cost of production is increasing day-by-day. A producer can only grow faster and economy can only have the fast economic growth, when the economy is having a moderate or low cost of production. If it is increasing, if the cost of production is increasing, if the returns to scale is negative one is investing one dollar, but the return is only less than one dollar.

So, in that case a producer cannot really continue with the production. So, infrastructure affects the international competition and trade. Because, more you are in the competitive

world, more you are in the low cost production mechanism; China today proved that due to the low cost of production they are in the position to compete at the international level. And at the level of international trade they have also proved that with the development of infrastructure they can really have a change in the international trade sector.

So, it really attracts the foreign investment, better infrastructure, because investors are looking for those destination, where the return is very high and return cannot be very high when the infrastructure is in the poor stage. So, if the infrastructure is really in a very good stage foreign investors are also looking to join.

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Infrastructure affects the domestic market conditions, the expansion of domestic market in the Rosenstein Rodan model and Ragnar Nurkse's model we have seen that the size of the market is very important for the growth. If the size of the market is small, if it is traditional, if it is dependent only on the agriculture sector then infrastructure is going to break that dead lock and infrastructure is really changing the size of the market, interconnecting the market and transforming the market in a different way.

So, effect on technological innovations comes when you have new infrastructure added in the market. If you do not have new infrastructure added in the market, the occupational structure is not changing, people expectations are not changing, people's mobility is not there, factors of productions are not really mobile and ultimately new technologies are not demanded and not innovated. So, infrastructure is by and large

contributing to the individuals welfare, because more you are growing with a better infrastructure facility, more you are really concerned about individuals welfare also.

Labour productivity is again interconnected, because a person can reach on time, a person can be very safe on the way to join their factory, if they have really better infrastructure facility. If the infrastructure transportation facility is poor, road conditions are poor, a labor cannot be so mobile, a labor cannot be so productive. Because, a labor will be very tired or may not be very active on the work place due to the bad infrastructure, such as road, transport and other things.

At the same time infrastructure and environment today is one of the major area of discussion and whatever infrastructure is developed today, companies do take care for the developing infrastructure with less interference in the environmental conditions. So, I think with this discussion we are understanding that how infrastructure is really boosting the economic growth process and how the production possibility curve is shifting from the previous level to the new level. And again it is shifting towards the rightward side to get more prosperity in the economy. Hope this particular discussion will help you to understand how infrastructure is really one of the major components for the economic growth process.

Thank you.