

Professor Malik Khosru Chowdhury Memorial Lecture  
Session: ***Physical Infrastructure and Economic Development***

## **Physical Infrastructure and Economic Development**

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### **Preamble**

Everybody who has studied economics remembers that, somewhere in the elementary economics textbooks, there is usually a flow diagram which shows how the basic economic agents, producers/firms and consumers/households are linked and for which activities. In this diagram consumers/households derive income in various forms such as rent, wages, profit or interest and use the income for purchasing various goods and services, which are produced by a group of producers/firms.<sup>1</sup> The diagram usually is silent on how the consumers and the producers get together.

Time was when those wishing to purchase goods or services had to go to the producer physically to buy them. Later they began to congregate in certain places at appointed times of the week (the market place) or the year (annual fairs or exhibitions). Market places for congregation and roads to connect markets with villages and towns came into existence. These were the early examples of physical infrastructure. These still are two of the major types of such infrastructure. In my presentation, I shall specifically focus on the manner in which one particular type of infrastructure, rural roads, may be vital link in the development process of the country.

### **Definition of infrastructure**

At this stage one needs a definition of infrastructure. Hirschman defined infrastructure to include all services such as law and order through education and public health to transportation, communication, power and water supply, as well as such agricultural overhead as irrigation and drainage systems. The essential

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<sup>1</sup> Some of the buyers themselves are also producers.

characteristics of these services is that no production can take place without inputs from them. Thus, infrastructure is necessary input into the production process or in raising the quality of life. Since the time of Hirschman, however, various other kinds of physical infrastructure have come into existence such as the Internet and other IT-related services. Then again, Hirschman defined infrastructure as essentially publicly provided services or facility. It is no longer so. Private provision of infrastructure is now commonplace in many countries. Yet, on the whole physical infrastructure is still largely publicly-owned.

Many types of infrastructure share a characteristics or two. Except electricity, none of these are direct inputs into the production process. These only facilitate the production process through services such as marketing of inputs and output, and collection of information. Electricity, however, may be a direct input into the production process by providing the motive power for irrigation machines, machines in the rural factories and providing other energy services which are part of the production inputs.

The second characteristics many of the infrastructure share is that some of them such as roads and markets are like quasi-public goods. They have the quality of public goods in the sense that once put in place, no body may be denied their use. On the other hand, while pure public goods do not diminish in extent or quantity for one person due to use by another, in the case of roads and markets, the use by one person may restrict to certain extent the use by another, though not necessarily entirely. Thus, any body may use a rural road. But, if the distance traveled is long, a bus service may be needed, the use of which and consequently of the road may be restricted both by resources available to a person and the total capacity of the bus service. Other services such as telecom, electrification and Internet are used more as private goods. No user has free access and the use by one curtails the use by another due to capacity congestion.

A third characteristics is that the services of some of these are not divisible and tradeable. These include roads and markets. Others such as electricity and telecom services are in theory non-tradeables, but in practice may not be. Their services may also be divisible to certain extent. Thus, a telephone connection may be used by many users in sequence. Such characteristics have important implications for their use by the people.

### **Rural roads network**

Allow me now to turn to the situation regarding the state of rural roads in Bangladesh. Such roads are of several types. There are national highways and regional roads, which are generally hard-surface all weather roads, and 2 types of feeder roads, Feeder Road A connecting Upazila headquarters with the arterial

network, and Feeder Road B that connects growth centres to RHD network. There are 3 types of so called Rural Roads which are more in the nature of small locality roads.

By June 2000, the Roads and Highways Department (RHD) had under its jurisdiction nearly 21 thousand km of roads of which nearly 13 thousand had been all weather hard surface road. The LGED had, up to February 2001, constructed a total of nearly 31 thousand km of rural roads of all types. By the beginning of 2001, Bangladesh thus had some 50 thousand *plus* km of roads of various quality. Indicating a very high density of road network.

### **Future demand for road services**

Is the present road network adequate to serve the needs of the economy. The Bangladesh Transport Sector Study (1994) shows that about 70 percent of the traffic for movement of goods or people is road, which indicates the importance of road in the transport network. In mid-1990s, the total inter-district demand per day for goods traffic was more than 5 times the intra-district demand. By 2005, the ratio of the respective demands is projected to be 1:2. By 2010, the ratio is expected to remain the same as both the inter-district and intra-district demand will increase by nearly 50 percent. What these indicate is that the inter-district goods movement may be outweighed by intra-district movement. This means an increasing demand for services of local roads, particularly the Feeder roads A and B. This kind of change in the level and the nature of demand should be considered while planning for road construction and improvement.

### **Linkages between rural infrastructure and, growth and poverty**

How does rural infrastructure such as a road contribute to growth and poverty reduction? The impact may be both direct and indirect. In fact the indirect impact is likely to be much more substantial than the direct ones.

Initially during construction, the poor may be employed as unskilled labour for moving earth the extent of which may be very large as in some cases almost the entire construction may depend on unskilled labour. Once a road is under construction or is completed, there may be three types of impacts.

The first type of impact is due to the usual linkage effects of the construction activity. The construction of a road necessitates inputs from other economic activities and thus provides an impetus to the growth of output and consequently additional employment and income from the latter. This probably will happen more in case of the hard-surfaced (national and regional) highways and roads in which case such intermediate inputs (bricks, cement, bitumen, fuel) are more

common. But the direct employment and income linkages may be discernible more in case of other types of roads, e.g., earthen roads the construction and repair and maintenance of which are very labour intensive. The second type of impact relates to the consumption linkages that may occur due to the immediate employment and income impact on the poor which may provide another impetus to the growth of output of goods and services that the poor consumes.

The most important probably is the third kind of impact and are the ones to which Hirschman alluded. This relates to the services and their intensity that the roads provide and the consequent effects on output, employment and income. The intensity of service a road provides depends on the modes of travel that may be used and the extent and nature of networking that are in place. A hard-surfaced, all-weather road (national and regional roads) may be utilised for all kinds of traffic, motorised and non-motorised and for long as well as short distance travels, which influence the type of vehicle used. Less and lower durable the road is and the lower its quality, the shorter travels may become more frequent and consequently the modes that may be used.

The initial impacts after construction are thus of two types, viz., increase in the traffic on the road using various means. The traffic may be either entirely new or in part diverted from an existing road system. It is the new and additional one, which is of interest for incremental value added in the economy as the new traffic means additional direct income for those who own the travel modes and are employed therein.

Now as a new or an improved road is in place, additional traffic is generated raising the movement of both passengers and goods. The traffic also becomes faster and cheaper. The cost-savings is likely to be passed on in various degrees to the final consumers, the producers (i.e., consumers of intermediate goods and sellers of output) lowering the cost of production. Better transport may also lead to better farm gate prices as marketing intermediaries may reach farmers more easily than before. And so long as the poor is employed in the economic activities, they gain in terms of employment and income. These are all tangible gains.

How much of the traffic is generated also depends on the networking that the link roads (particularly Feeder roads A and B in Bangladesh) provide with the national and regional highways. The more the links, the more is likely to be the traffic as the catchment area enlarges and higher will be the density of economic activity around the particular link.

As the transport system develops, people move for business, pleasure, social interactions, education and schooling. These are usually intangible benefits which are not easily quantifiable are thus rarely taken into consideration in the

conventional cost-benefit analysis of roads. The benefits of a road are thus often undervalued.

The poor may benefit from roads in three ways, apart from the intangible ones; first, during construction, secondly due to employment in geared up transport services and thirdly due to the increased level of economic activity. Particularly, if roads are constructed in areas where there had been previously not much of such infrastructure or where geographical isolation due to natural barriers or other impassable conditions (heavy rains making dirt roads into muddy pools as often happens in this country), the end of such isolation may bring dramatic changes in the lives of the poor.

One caveat is in order here. Unless roads connect to markets (which may also be urban centres, not simply physical market places) neither may be of much help in generating economic benefits although there may be certain improvement in quality of life; and in fact, it is the junctions of roads that often evolve into market places. In that sense, the markets and roads are complementary to each other.

### **Impact of rural roads and other infrastructure: The evidence**

Any hypothesis must be tested with real life data. Many have tried to do so despite severe data problems. For a comprehensive survey, see Jimenez (1995).

The evidence on the over-all impact or its distribution appear to indicate that there may have been not much of an impact of roads or other similar infrastructure. The results of Canning (1999) indicate significant contributions of capital and telephones but not of electricity generation or transport. But the results are problematic due to measurement problems related to capital.

The evidence on the distribution of impact of infrastructure is also not clear-cut. Inter-country comparisons indicate that the poor are mostly deprived from their services (Komives, Whittington and Wu: 2001). Lower income means more restricted access to electricity, telephones, piped water or sewer services, more so in the low-income countries. Note that all these types of infrastructure are more in the nature of private goods and the access therefore is restricted to people with low income. Other studies such as Chong and Calderón (2001) have demonstrated that provision of infrastructure helps in lowering income-inequality, and more so if the quality of the infrastructure is good.

The above infrastructures are as indicated earlier more private goods. Roads, in contrast, are semi-public goods and thus the poor may not be priced out. Analysis of data from Nepal (Jacoby: 1998) indicate that better access to cheaper inputs and better marketing of output allow impact of roads to be capitalised in the value of land. The nearer a piece of land gets to the market due to a road

construction, the more, everything else remaining the same, is its value. Also the impact on land value is widely shared by all landowners. Of course the existence of such roads do not directly affect the landless.

### **Bangladesh evidence**

Studies from Bangladesh in the 1980s clearly indicated the influence of infrastructure on income of villagers or its various elements (Asaduzzaman, Hossain and Saha: 1985; Hossain and Asaduzzaman: 1982). More comprehensive studies (Ahmed and Hossain: 1990) which compared infrastructurally developed and less developed villages, found that developed villages had far higher proportion of land under irrigation, fertiliser use and higher wage income for workers. Farm gate price of rice or the level of income were comparatively higher but not substantially.

Many other studies have documented the positive impact of rural roads. In some cases, indirect employment generation through establishment of new shops and generation of traffic took place. Farm gate prices for agricultural commodities rose while goods imported in the area such as kerosene, fertiliser, and salt fell. Because of road improvement, the transport charges on the road also fell. The immediate reason was a greater competition among transport service establishments.

Similar positive changes have occurred in case of other improved road areas such as in case of RRMIMP – 1. Both passenger and cargo traffic increased while the transport charges fell on the improved roads by 48 percent for goods and 69 percent for passengers raising further the volume of traffic. The economic rate of return, even ignoring intangibles (as discussed earlier), were substantial, 22 percent for both road improvement and market improvement. These are very high rates of return. Including intangibles, the returns are likely to be much higher.

The various stimulus that are generated in the local economy, such as lower input prices, higher output prices, lower transport costs, higher volumes of traffic and sales all should be reflected in general agricultural productivity due to higher potential profits. The question is did it happen in Bangladesh. Field evidence shows that this did indeed happen, more so for better quality roads with market links.

Support to the idea that good quality roads matter in lowering costs of travel, comes from an on-going study by BIDS (BIDS: 1998). This study also suggests that there may be large intangible gains when roads are constructed or improved. Another recent study in BIDS (BIDS: 2001) clearly indicates that there is a positive impact of infrastructure on poverty reduction. Using information from a

very large sample, it has shown that average income is higher in villages connected with good transport network, households with electricity and where the household head and the spouse are educated.

Finally, I would like report on one of my recent exercises. This clearly indicates that road density has a positive impact on irrigation intensity and power tiller use. But there is an optimal upper limit to the density beyond which its marginal effect becomes negative. Furthermore, the analysis also suggests that there may be an optimal ratio of all weather roads to local roads.

The positive impacts of rural roads are also evident from the linkage and multiplier indices. For example, the output linkage effect of construction of rural road is 1.82. That is one unit of direct output of road leads to an additional 0.82 units of indirect output effect. For employment, the effect is slightly less at 1.35.

### **A few recommendations**

Before ending, I would like to make a few recommendations for an improved and economically effective rural road and infrastructure policy in Bangladesh. First, more attention should now be given to quality rather than the almost mindless construction of rural roads. Secondly, effort must be given to attain an optimum ratio of local and national/regional roads. Thirdly, while designing road improvement or new construction, equity as well as efficiency should be given due consideration. One at the exclusion of the other will be practically useless. And finally, stakeholders' active participation in the planning and implementation stage is absolutely vital for the success of the road construction and improvement programme, particularly as much of the new demand for traffic is likely to be local.

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