INFRASTRUCTURE DEVELOPMENT IN INDIA
AN APPRAISAL

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INTRODUCTION

Infrastructure is generally defined as the physical framework of facilities through which goods and services are provided to the public. The infrastructure sector covers a wide spectrum of services such as transportation (including roadways, railways, airways and water transportation), power generation, transmission and distribution, telecommunication, port handling facilities, water supply, sewage disposal, irrigation, medical, educational and other primary services. Some of these services have a direct impact on the working of a business enterprise, while others are more important from a societal point of view. It contributes to economic development by increasing productivity and by providing amenities that enhance the quality of life. Its linkages to the economy are multiple and complex. It affects each of the economic activities such as production, consumption, distribution, trade, etc directly or indirectly having both the positive and negative externalities. The availability of adequate infrastructure facilities is imperative for the overall economic development of a country. Infrastructure adequacy helps determine success in diversifying production, expanding trade, coping with population growth, reducing poverty and improving environmental conditions.

The relationship between each of the infrastructure sectors and the environment is complex. Infrastructure has got both the positive and negative effects on the individuals, society, economy and the natural environment. Negative environmental effects often result from a failure to take account of interdependencies among infrastructure sectors. For example, under investment in sewerage relative to water supply in many places has led to harmful contamination of water reserves, exacerbated flooding, and reduced the health benefits from investments on water. Poor management of solid waste and inappro-

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priate disposal further complicates wastewater disposal and urban street drainage leading to health hazards in the big cities. There are also some positive environmental impacts of infrastructure. For example, reclaimed landfill sites and wetlands used for sewerage treatment can be developed into recreational parks. Duckweed ponds can serve both as wastewater treatment and a source of high-quality protein feedstock for animals. Methane can be extracted from sewage treatment plants and from the decomposition of organic matter in landfills and used as fuel. Sewage water can be used for irrigation purpose after being treated. A good infrastructure in the form of improved transport can increase the productivity of worker through better management of time spent by them on non-productive activities. Improvements in water supply and sanitation also can have positive impact on the health of the workers, thereby increasing their productivity. A better infrastructure in various forms helps the poor earning more for their livelihood and thus leading to reduction in poverty and inequality.

A number of research studies have been undertaken in the recent past on various aspects of infrastructure and its effects on development {Barry (1994), Bond Gary (1994), Chandavarkar (1994), Jamal-ud-din (1994), Kohli (1994 and 1995), CMIE (1995), CII (1995), Jha (1995), GOI (1996) and Nayak (1999)}. Some studies are devoted to estimation of productivity of infrastructure investments while others are attempts to find a nexus between growth and investments on infrastructure. Though a positive and significant relationship between growth and investment on infrastructure has been established using time series data, scholars have failed to have a consensus view on the causality between these two factors. Whether increase infrastructure causes growth or growth causes increased infrastructure is yet to be fully established. However, a strong correlation exists between per capita GDP and availability of certain services such as telecommunications, power, roads, and access to safe drinking water etc. With the rise in per capita GDP, composition of infrastructure changes significantly. Basic infrastructure such as water and irrigation are more important in less developed countries whereas power and telecommunication play a vital role in highly developed countries. As the economy progresses, the share of agricultural infrastructure shrinks and other infrastructure take their place for speedy development of industrial and service sectors.

INVESTMENT ON INFRASTRUCTURE PROJECTS

A recent World Bank study has estimated that developing countries as a whole invest about $200 billion per year in physical infrastructure facilities (GOI, IIR, 1996, p.3). This is about 4 percent of their GDP. About $160 billion (80%) is financed through domestic public resources and $25 billion (12.5%) through international development assistance and the remaining $15 billion (7.5%) through private capital. The private sector's share in infrastructure investment is still small though rising at a faster rate in many countries and sectors. The East Asian economies have steadily increased infrastructure investment in absolute terms and as a proportion of their GDP. Total investments have increased from 3.6 percent in the 1970s to about 4.6 percent in the 1980s and to 5.5 percent in 1993. The Indian experience in this regard is not too different. At the aggregate level, total investment on infrastructure at 1995-96 prices increased from about Rs.61 billion in 1980-81 to about Rs.290 billion in 1990-91 and about Rs.500 billion in 1994-95 (Table 1). At constant 1980-81 prices the total infrastructure investment doubled over the decade from Rs.60 billion to Rs.120 billion in 1990-91 and further in the 1990s to about Rs.150 billion in 1994-95. As a proportion of GDP, total investment in infrastructure ranged from about 4.5 percent to 6.0 percent, but broadly averaging about 5.5 percent of GDP during the late 1980s and early 1990s. Average level of infrastructure investment in the first half of the 1980s was about 4.8 to 5.0 percent of GDP. A significant increase took place in the second half of the 1980s, during the Seventh Plan period, when the average level increased to about 5.6 percent of GDP. As a proportion of total gross domestic investment, GDI in infrastructure has varied between 20 to 25 percent since the early 1980s. This pattern broadly conforms to international experience where investment in infrastructure is typically found to comprise about 20 to 25 percent of gross domestic investment.

PATTERN OF INFRASTRUCTURE INVESTMENT

Sectored analysis of infrastructure investment reveals that there has been a significant change in the pattern of investment (Table 2). There has been an increase in the share of investment in the communication sector, which has gone up from 0.3 percent

of GDP in the early 1980s to about 0.8 percent in 1994-95. The share of railway is remarkably constant at about 0.6 percent of GDP, and that of 'other transport' has ranged between 1.3 and 1.6 percent. Investment in electricity, gas and water had tended to increase from an average of about 2.5 percent of GDP in the early 1980s to about 3 percent in the late 1980s, but has again declined to about 2.5 percent in 1994-95. There has been a trend of massive expenditure on telephones. It is expected that in the coming decades, the Asia-Pacific Region is likely to spend more on telephones and power than anywhere else in the world. The capital investment needed to finance this development is estimated to run into trillions of dollars.

PUBLIC-PRIVATE PARTICIPATION

The bulk of infrastructure investment in India has been in the public sector, which has overall accounted for about 75 percent of total investment. The public sector has been the dominant investor in infrastructure in the second half of the 20th century. During the 1980s, when total infrastructure investment ranged from 4.5 to 5.5 percent of GDP, public sector investment ranged from 3.5 to 4.3 percent (Table 1). The private sector investment in infrastructure has generally been in the range of 1.0 to 1.6 percent as a proportion of GDP. It is mainly in 'other transport' that the private sector has so far been active: this is primarily in the investment in the road cargo industry and in bus transport. The railways and communication sectors have been totally owned by the Government whereas there has been some marginal participation of the private sector in power. As a proportion of total public sector investment, infrastructure has ranged between 35 and 47 percent during the 1980s and early 1990s.

The public sector supplies more than 90 percent of the investment in power, water supply and sanitation, railways, roads, telecommunication etc. The private sector is only a marginal player in each of these areas at present. Currently, private sector participation is being actively pursued in the provision of power, telecommunications and for a segment of roads. Discussion has already begun on private participation in urban infrastructure but arrangements enabling such participation are still to be made. Expecting a gradual growth in the participation of private sector in infrastructure development, the Expert Group on the Commercialization of Infrastructure Projects set up in October 1994 by the

Department of Economic Affairs, Ministry of Finance, Government of India, projected the share of private sector to increase from about 20 percent in 1995-96 to about 44 percent by 2005-06 (Table 3). This would mean an increase in private sector infrastructure investment from 1.1 percent of GDP in 1995-96 to about 3.5 percent in 2005-06. In other words, there would be an increase of investment from Rs.121 billion to Rs.807 billion during the same period by the private sector.

INFRASTRUCTURE INVESTMENT REQUIREMENTS

Infrastructure investment as a proportion of the total gross domestic investment (GDI) in India comprised about 22 percent to 24 percent throughout the 1980s. This ratio had the tendency to increase towards the latter part of the decade. A similar pattern on infrastructure investment was also observed during the same period in the first growing East and South East Asian countries (India Infrastructure Report, p.44). Their gross domestic investment rates increased to over 30 percent of GDP, rates of infrastructure investment rose correspondingly to levels of 7 to 8 percent of GDP. Taking into consideration of the Indian experience over the last 15 years from 1980-81 to 1994-95, observing the broad generalities of infrastructure investment across the world, and examining in [particular the East and South East Asian experience the Expert Group projected gross domestic investment in infrastructure in India to grow from the level of 5.5 percent of the GDP in 1995-96 to 8.0 percent in 2005-06 (Table 3). Thus it would continue to comprise 21 to 25 percent of GDI in 2005-06. In absolute terms, the total annual infrastructure investment were projected to rise from about Rs.600 billion (US $17 billion) in 1995-96 to Rs.1826 billion (US $51 billion) in 2005-06 at 1995-96 price level and exchange rate US $1= Rs.35. This implies that the total infrastructure investment in India would amount to about Rs.7455 billion (US $213 billion) during the five year period from 2001-02 to 2005-06 and Rs.12, 400 billion (US $354 billion) during 1995-96 to 2005-06. For a similar period from 1995 to 2004, the World Bank also estimated that to maintain 7 to 9 percent economic growth rate, countries in East Asia would need to invest between 6.5 to 7.0 percent of their GDP in infrastructure (IIR, p.44).

According to the sectoral projections (Table 4), annual investment in power was to increase from about Rs.300 billion in 1995-96 to about Rs.680 billion by 2005-06. Similarly, investment in urban infrastructure were to increase from Rs.75 billion to Rs.602 billion during the same period; in roads from Rs.30 billion to about Rs.148 billion; in communication from about Rs.75 billion to Rs.312 billion and in ports from about Rs.10 billion to Rs.40 billion.

PRIVATE FINANCING OF INFRASTRUCTURE

There has been a worldwide trend of massive investment in infrastructure and it is likely to increase at a faster rate in the coming future. Therefore, the capital requirement for this rapid growth of investment would be unmanageable on the part of the public authorities in different countries of the developing world. This will force particularly the Asian governments to rely increasingly on private capital. According to a World Bank estimate 7 percent of the investment in infrastructure in developing countries came from private sector during 1994-95 and it was likely to double within a period of 5 years (IIR, p.54). Thus the scope of private financing of infrastructure investment is immense in developing countries.

Private capital is finding its way into infrastructure through privatization of existing utilities as well as through construction of new projects on a build-operate-transfer (BOT) basis allowing the contractors to build the project and then to make money by keeping a fixed share of revenues the projects generate. Private finance for infrastructure can be tapped from the commercial banks, stock markets or bond markets. But the experience suggests that the appetite of commercial banks for infrastructure projects is limited. In fact, it is the capital markets which have emerged as the major source of private finance for infrastructure. Between 1988 and 1992, developing countries raised $62 billion through privatizations. Asia raised $7 billion and is all set to increase its share. Bond markets are the third major source of private finance for infrastructure. They command large amounts of capital and are comfortable with maturities of 15 to 20 years, which tend to bother banks. The bonds, however, still not sovereign guarantees to succeed. The problem is that the governments are over burdened with their debts and hence such sovereign guarantees are increasingly hard to come by.

The most obvious problems for infrastructure projects are political. In many countries, infrastructure facilities are subsidized. Investors will put in financial capital only if they can be sure that a government will in return commits its political will to the tricky business of phasing out subsidies. In reality, many governments are facing immense opposition from their political rivals while implementing the programmes of phasing out subsidies and sometimes them failing to do so. This has become a handicap on infrastructure development.

COMMERCIALIZATION OF INFRASTRUCTURE

The need of the hour in the present phase of economic development is the commercialization of infrastructure projects. Investment must be made on those infrastructure projects which can recover its invested resources through a system of user charges. The services of investment projects should no more to be continued as a free good. Such user charges should bear a direct relation to the specific benefits that the facility provides the user. Since the infrastructure projects have a tremendous positive externality, which come in the form of secondary and tertiary benefits to the people and society, it provides the essential rationale for the governments to provide fiscal incentives to investors setting up these projects. Commercialization would involve giving service providers, whether in the public or private, well-defined budgets based on revenues from users, and managerial and financial autonomy, while at the same time, holding them accountable for their performance. The efficacy of commercialization, however, would be contingent upon the ability to segregate payers and non-payers and prevent any incidence of free riding. The cope for enforcing excludability would be one of the key parameters for facilitating commercialization. The other critical factor is the pricing of infrastructure services. In this connection it may be mentioned here that we have a long track record of uneconomic pricing and the extensive use of subsidies, which have been the principal obstacle in enforcing market-based pricing of these services in developing countries including India. Since plan allocations are supply-oriented in India often large errors have been committed due to lack of adequate cognizance of the existing and anticipated levels of demand for the services of infrastructure projects. Sometimes over investments are made in infrastructure much before the actual appearance of demand and

in some others there has been under investment because of failure to anticipate demand. As a result, significant portion of these investments could not yield adequate returns.

The key problem in commercialization of infrastructure projects is the appropriate allocation of risk. In the public sector, the risks in infrastructure projects are internalized within the government. But if we want a commercialized infrastructure, there is an urgent need for appropriate demarcation and allocation of risks to the different skate holders in the project so that there is no scope on the part of the private investors to shift the risk to others including the government.

INFRASTRUCTURE PRIVATIZATION: SOME SUCCESS STORIES

The experience of the developed countries regarding privatization of infrastructure is quite successful and it has assumed different forms in different countries. One of the bright examples is the '*Stadwerke*', which is an integrated municipality utility company in Germany that supplies water along with other utilities including electricity, district heating and public transport. The *Stadwerke* are for the most part owned and controlled directly by the municipalities. In recent years, some municipalities have started experimenting with new arrangements due to financial constraints. The municipality of Wedemark contracted with a private company to integrate a number of local sewerage systems into a single modern network and to construct a new sewage treatment plant. The municipality sold the existing installations to the private company benefiting the public budget. After 25 to 30 years, the plant will revert to municipal ownership. The municipality of Rostock in former East Germany has transferred ownership of its water services to *Eurawasser,* a subsidiary of the French company, '*Soc. Lyonnaise des Eaux-Dumez*', and the German company, '*Thyssen*'.

Since the early 1980s, there has been a radical restructuring of water supply and sewage treatment in England and Wales through privatization. Privatization was carried out by means of a public floatation of shares. The establishment of three regulating agencies accompanied it. The Office of Water Services (OFWAT), under its Director General, acts as an economic regulator for the industry, while the National Rivers Authority and the Drinking Water Inspectorate are responsible for environmental and technical standards. The Director General of Water Services (DGWS) licenses the

companies so as to ensure total coverage of England and keeps control on them through the regulation of water price and sewerage charges.

Argentina which suffered long from severe water shortages, leaks, lack of water pressures and poor sanitary conditions, sold its State Company *Obras Sanitarias de la Nacion* (OSN) in 1993 to *Aguas Argentinas*, a company formed by seven local and foreign partners led by *Lyonnaise des Eaux* and has been able to achieve good results in three crucial areas such as delivery of clean water, adaptation and modernization of water sewerage facilities and generation of profits. The day to day operations of *Aguas Argentinas* is managed by *Lyonnaise des Eaux*, a Paris-based world leader in water supply and waste management. *Sociedad Commercial del Plata* is one of the Argentina's largest local groups, with investment in oils and gas, engineering, construction, and railroads. *Sociedad General de Aguas De Barcelona* serves 10 percent of the private water market in Spain and assists the French group in the hands-on management of *Aguas Argentina*. Mellor is one of Argentina's largest textile firms and has also branched out into the telecommunications and public work sectors. Some of the major steps undertaken by the new consortium to convert the overstaffed, underachieving and generally chaotic operation into more efficient and viable ones are reduction in staff to the extent of 52 percent through early and voluntary retirement schemes and installation of meters and other devices to measure water delivery to consumers. These are some of the bright examples of infrastructure management by the private authorities at the global level from which other developing nations including India can take lesson to bring speedy growth to the economy through development of infrastructure.

CONCLUSION

Almost all of infrastructure investment was earlier made by the public sector in India. Government funds were allocated to different levels of government and infrastructure entities essentially through the plan process. These funds were allocated in the form of grants to different levels of government, or as equity or debt contributions to public sector entities such as public sector corporations including specialized financial intermediaries such as Housing and Urban Development Corporation (HUDCO), State Electricity Boards, various authorities, departmental undertakings and the like. A major

fiscal change that has taken place over the last decade is that there is now no positive balance of current revenue (BCR) to allocate for investment for any purpose. Consequently, all infrastructure investment made by the government is essentially from borrowed funds. Since investment requirements for infrastructure are bound to increase as per the estimates of the Expert Committee the government investment will therefore have to increase at a rate slightly higher than that of GDP growth. Thus all most all the incremental growth in infrastructure investment will have to come from the private sector. Consequently, huge demands will be made on the capital markets for raising resources by the government and private sector alike. It is expected that a third of net foreign capital flow to flow into infrastructure. The rest will have to be mobilized from the domestic capital market and hence there is a need for capital market reforms, which can go a long way in helping to a great extent in improving the infrastructure in India.

Since private investment in infrastructure is inevitable, and if we want it to be made on sustainable basis, it is necessary to reduce both the perception and the reality of risk. The basic approach to risk management should be based on the principle that the party best able to manage a risk at least cost should mitigate it. Consequently, the private sector sponsor would need to bear the commercial and managerial risks, while the government would need to manage the country and the political risk. The latter would involve a set of policies and actions necessary to promote overall economic growth. These policies and actions would encompass two elements. The first would involve maintenance of stable macro-economic environment to ensure price and exchange rate stability and facilitate stable and modest real interest rates. Policy actions should move towards foreign exchange convertibility in order to protect the interest rate of the foreign investors without whom it would be difficult to go ahead with the programmes of privatization of infrastructure investment. The second element would cover the creation of a transparent and equitable regulatory framework governing corporate activity, stable and predictable tax regimes, a credible and reliable judicial system and dispute resolution mechanism.

Table 1

INFRASTRUCTURE INVESTMENT IN INDIA

Year	Investment on Infrastructure (Rs.in Billion)			Investment on Infrastructure as a percentage of				GDI	
	Public Sector	Private Sector	Total	GDI	GDP			Amount (Rs.in Billion)	% of GDP
					Public Sector	Private Sector	Total		
1980-81	47.7	13.1	60.8	19.7	3.5	1.0	4.5	308.8	22.7
1981-82	58.3	21.8	80.1	23.4	3.6	1.4	5.0	342.1	21.4
1982-83	70.3	21.6	91.9	25.3	3.9	1.3	5.2	363.4	20.4
1983-84	73.2	22.5	95.7	22.9	3.5	1.1	4.6	418.1	20.1
1984-85	86.3	26.3	112.6	24.8	3.7	1.2	4.9	454.7	19.7
1985-86	104.1	32.4	136.5	23.5	4.0	1.2	5.2	581.7	22.2
1986-87	142.3	33.9	176.2	28.8	4.9	1.1	6.0	611.6	20.9
1987-88	145.2	39.2	184.4	24.1	4.4	1.1	5.5	764.6	22.9
1988-89	167.1	52.3	219.4	22.6	4.2	1.3	5.5	969.7	24.5
1989-90	193.5	58.2	251.7	22.1	4.2	1.3	5.5	1138.2	24.9
1990-91	217.3	70.1	287.4	19.8	4.1	1.3	5.4	1448.5	27.0
1991-92	266.5	84.0	350.5	24.3	4.3	1.4	5.7	1440.2	23.4
1992-93	278.4	108.9	387.3	23.7	3.9	1.6	5.5	1631.8	23.1
1993-94	346.9	105.3	452.2	25.5	4.3	1.3	5.6	1773.3	21.6
1994-95	387.1	107.0	494.1	20.7	4.1	1.1	5.2	2384.1	25.2

Source: India Infrastructure Report, 1996.

Note: GDP and GDI respectively refer to Gross Domestic Product and Gross Domestic Investment.

Table 2

SECTORAL COMPOSITION OF INFRASTRUCTURE INVESTMENT IN INDIA

(Amount: Rs. in Billion)

Year	EGW		Railways		Other Transport		Storage		Communication	
	Amount	% of GDP	Amount	% of GDP	Amount	% of GDP	Amount	% of GDP	Amount	% of GDP
1980-81	31.7	2.3	8.1	0.6	17.5	1.3	0.2	0.0	3.2	0.2
1981-82	42.1	2.6	9.8	0.6	22.6	1.4	0.4	0.	5.2	0.3
1982-83	48.3	2.7	10.7	0.6	26.8	1.5	0.3	0.0	5.8	0.3
1983-84	5.6	2.4	11.9	0.6	25.9	1.2	0.6	0.0	6.8	0.3
1984-85	55.5	2.4	14.0	0.6	34.3	1.5	0.5	0.0	8.3	0.4
1985-86	72.4	2.8	16.9	0.6	37.4	1.4	0.6	0.0	9.2	0.4
1986-87	96.3	3.3	23.1	0.8	45.3	1.5	0.8	0.0	10.7	0.4
1987-88	103.8	3.1	21.5	0.6	44.0	1.3	0.8	0.0	14.3	0.4
1988-89	113.0	2.9	26.4	0.7	57.9	1.5	0.8	0.0	21.4	0.5
1989-90	123.4	2.7	26.4	0.6	73.6	1.6	0.9	0.0	27.3	0.6
1990-91	144.1	2.7	30.8	0.6	83.3	1.6	0.7	0.0	28.6	0.5
1991-92	189.0	3.1	33.2	0.5	95.8	1.6	0.5	0.0	32.1	0.5
1992-93	189.8	2.7	49.2	0.7	97.8	1.4	0.5	0.0	50.0	0.7
1993-94	213.8	2.7	55.8	0.7	124.4	1.6	0.6	0.0	57.5	0.7
1994-95	233.0	2.5	59.6	0.6	128.9	1.4	0.6	0.0	72.1	0.8

Source: India Infrastructure Report, 1996.
Note: GDP and EGW respectively refer to Gross Domestic Product and Electricity, Gas and Water Supply.

Table 3

PROJECTED INVESTMENT ON INFRASTRUCTURE IN INDIA

Year	Investment on Infrastructure (Rs.in Billion)			Investment on Infrastructure as a percentage of				GDI	
	Public Sector	Private Sector	Total	GDI	GDP			Amount (Rs.in Billion)	% of GDP
					Public Sector	Private Sector	Total		
1995-96	477.4	121.2	598.6	21.2	4.4	1.1	5.5	2825.5	26.0
1996-97	511.1	163.9	675.0	21.8	4.4	1.4	5.8	3091.4	26.6
1997-98	546.3	212.4	785.7	22.4	4.4	1.7	6.1	3391.1	27.3
1998-99	587.2	265.2	852.4	23.1	4.4	2.0	6.4	3696.4	27.8
1999-00	639.7	316.7	956.4	23.5	4.5	2.2	6.7	4075.5	28.6
2000-01	693.4	382.6	1076.0	23.8	4.5	2.5	7.0	4512.0	29.4
2001-02	750.4	442.4	1192.8	24.2	4.5	2.7	7.2	4930.0	29.8
2002-03	806.4	518.1	1324.5	24.5	4.5	2.9	7.4	5415.3	30.3
2003-04	872.9	599.4	1472.3	24.8	4.5	3.1	7.6	5938.8	30.7
2004-05	938.0	701.1	1639.1	25.1	4.5	3.3	7.8	6523.4	31.0
2005-06	1019.4	806.7	1826.1	25.4	4.5	3.5	8.0	7179.5	31.5

Source: India Infrastructure Report, 1996.

Note: GDP and GDI respectively refer to Gross Domestic Product and Gross Domestic Investment.

Table 4

PROJECTED SECTORAL INVESTMENT ON INFRASTRUCTURE IN INDIA

(Rs. in Billion)

Year	Power	Urban Infrastructure	Railways	Roads	Ports	Communication
1995-96	300.0	75.0	72.9	30.0	9.6	75.4
1996-97	308.0	92.4	79.8	38.8	15.0	102.0
1997-98	336.0	113.8	87.5	47.8	16.8	144.0
1998-99	364.0	140.1	95.4	59.7	18.9	184.0
1999-00	392.0	172.6	105.2	75.9	21.3	165.0
2000-01	434.0	212.5	116.4	97.9	23.9	153.0
2001-02	476.0	261.7	127.2	105.7	26.5	182.0
2002-03	518.0	322.3	139.8	114.4	29.3	191.0
2003-04	560.0	397.0	153.3	124.2	32.5	232.0
2004-05	616.0	488.9	168.4	135.2	36.0	250.0
2005-06	679.0	602.2	185.3	147.6	39.9	312.0

Source: India Infrastructure Report, 1996.

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