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Rural Infrastructure and Growth: An Overview

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Rural infrastructure is crucial for agriculture, agro-industries and overall economic development of rural areas. It also, incidentally, provides basic amenities that improve the quality of life. However, infrastructure projects, including those in rural sector, involve huge initial investments, long gestation periods, high incremental capital output ratio, high risk and low rate of returns on investment. All these factors are not conducive for private sector entry into infrastructure. Further there are many attributes of infrastructure that make it difficult for individuals to design, construct, operate and maintain these services effectively and efficiently. As a result of this, infrastructure services, the world over, are largely provided by the public sector. Thus there are often good reasons for public sector involvement in the provision of rural infrastructure services, however in the production of such services there exists a role for other than public sector entities also (Ostrom *et al.*, 1993)

Infrastructure is an umbrella term for many activities referred to as social overhead capital by development economists as Arthur Lewis, Rosenstein-Rodan, Ragner Nurkse and Albert Hirschman. Lewis included public utilities, ports, water supply and electricity as infrastructure (Lewis, 1955) whereas Hirschman outlined four conditions that characterise infrastructure or social overhead capital: the services provided to facilitate or are basic to economic activity; the services are usually public goods because of economic externalities; these services cannot be imported; these investments tend to be indivisible or 'lumpy' (Hirschman, 1958). Later, in the sixties, besides the above, emphasis was laid on agricultural research, extension and rural financial institutions as important elements of infrastructure, due to increasing recognition of the role of agriculture in economic development and the vital role that infrastructure plays in generating agricultural growth (de Vries, 1960; Ishikawa, 1967).

The World Development Report of 1994 included the following in its definition of infrastructure

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- Public utilities - power, telecommunications, piped water supply, sanitation and sewerage, solid waste collection and disposal and piped gas.
- Public works - roads, major dam and canal works for irrigation and drainage.
- Other transport sectors-urban and inter-urban railways, urban transport, ports and waterways, and airports. (World Bank, 1994).

Other authors, like Ahmed disagree with this type of infrastructure definition, indicating that the concept has evolved since the early work of Lewis and Hirschman towards a more comprehensive definition that includes a wider range of public services that facilitate production and trade (Ahmed, 1996). In the case of agricultural infrastructure, they recognise the growing importance of its role in economic development: the related literature includes agricultural research, extension services, financial institutions and irrigation as part of a wider concept of infrastructure. The authors such as Fosu *et al.* (Fosu *et al.*, 1995), reflecting this broader definition, distinguish up to 11 components of agricultural infrastructure: irrigation and public access to water; means of transportation; storage services; commercial infrastructure; processing infrastructure; public services; agricultural research and extension services; communication and information services; land conservation services; credit and financial institutions; and, finally, health and education services. This listing makes reference to “rural infrastructure” before “agricultural infrastructure,” thus, as Fosu *et al.*, state, the conjunction of infrastructure services includes items that not only facilitate the development of agricultural activities, but also rural activities and sometimes even urban activities. A similar classification of agricultural infrastructure developed earlier by Wharton (Wharton, 1967), identifies three categories: one that is capital intensive (like roads, bridges and dykes); one that is capital extensive (principally extension services or vegetable and animal sanitation services); and the institutional infrastructure (that consists of formal and informal institutions). Wharton was one of the first to emphasise the importance of infrastructure in the generation of positive externalities at the microeconomic level. This author recognised that agricultural development is not exclusively determined by the “economic behaviour of the producers,” but also depends on the environment, which according to Wharton includes physical-climatic, socio-cultural and institutional components that form what he calls “the agricultural infrastructure”.

Adequate infrastructure raises productivity and lowers production costs, but it has to expand fast enough to accommodate growth. While the precise linkages between infrastructure and development are yet to be firmly established, it is estimated that infrastructure capacity grows step for step with economic output - a 1 per cent increase in the stock of infrastructure is associated with a 1 per cent increase in gross domestic product (GDP) across all countries (Summers and Heston, 1991). In his theory of ‘Stages of Growth’, Rostow considered social overhead capital, especially in transport and communication as one of the main pre-conditions for take-off (Rostow, 1960). The role of social overhead capital in accelerating economic growth

and in enhancing public welfare is more pronounced in developing economies as the indivisibility in the social overhead capital has been identified as one of the main obstacles of the development of under-developed countries (Rosenstein-Rodan, 1943).

Infrastructure for Agriculture and Rural Development

The models of development which focus on agriculture also bring about the role that infrastructure plays in agricultural development in particular. The spread of technology in agriculture depends critically on both physical and institutional infrastructure. It is also indicated that infrastructure plays a strategic role in producing large multiplier effects in the economy with agricultural growth (Mellor, 1976). Rural infrastructure leads to agricultural expansion by increasing yields, farmers' access to markets and availability of institutional finance. The kind of infrastructure put in place also determines whether growth does all that it can to reduce poverty. Most of the poor are in rural areas, and the growth of farm productivity and non-farm rural employment is linked closely to infrastructure provision (World Bank, 1994). It is estimated that 15 per cent of the crop produce is lost between the farm gate and the consumer because of poor roads and inappropriate storage facilities alone, adversely influencing the income of farmers (World Bank, 1997).

Rural infrastructure plays a key role in reaching the large mass of rural poor. When rural infrastructure has deteriorated or is non-existent, the cost of marketing farm produce can be prohibitive for poor farmers. Poor rural infrastructure also limits the ability of the traders to travel to and communicate with remote farming areas, limiting market access from these areas and eliminating competition for their produce. Construction of rural roads almost inevitably leads to increases in agricultural production and productivity by bringing in new land into cultivation or by intensifying existing land use to take advantage of expanded market opportunities. (IFAD, 1995). Binswanger *et al.* (1993), in a study of 13 states in India, found that investments in rural infrastructure lowered transportation costs, increased farmers' access to markets, and led to substantial agricultural expansion. Better roads also lowered the transaction costs of credit services, resulting in increased lending to farmers, higher demands for agricultural inputs, and higher crop yields. Fan *et al.* (1998) extend these results to show that rural infrastructure is not only an important driver for total factor productivity growth (TFP), but also directly contributes to a substantial reduction in rural poverty. Based on an econometric model and state level data for 1970-93, they find that the productivity enhancing investments offer a win-win strategy for reducing poverty while at the same time increasing agricultural productivity. If the government were to increase its investment in roads by Rs. 100 billion (at 1993 constant prices), the incidence of rural poverty would be reduced by 0.87 per cent and TFP would increase by 3.03 per cent. Similar investment in agricultural research extension would contribute to 6.08 per cent growth in TFP and 0.48 per cent reduction in rural poverty (Fan *et al.*, 1998).

For specific infrastructure impact cases (like the role of rural roads, telephones or access to electricity on poverty alleviation) the literature has a broad spectrum of work (Howe and Richards, 1984; Binswanger *et al.*, 1993; Jacoby, 1998; Lebo and Schelling, 2001). Improved infrastructure also leads to expansion of markets, economies of scale and improvement in factor market operations. The development of rural infrastructure helps to enlarge markets with greater access to factors of production. The female labour participation rate increases as traditional taboos against it are overcome (Rahman, 1993). Easier access to market allows an expansion of perishable and transport-cost intensive products. It can also lead to a conversion of latent demand into effective commercial demand. These effects of infrastructure accentuate the process of commercialisation in agriculture and rural sector (Jaffee and Morton, 1995). It has been observed that there was a direct relationship between increase in acreage of export crop cultivation and the standard of roads and distance from the main commercial centers. There is enhanced entrepreneurial activity, sharp decline in freight and passenger charges and improved services as a result of investment in rural roads (Bonney, 1964).

Impact of Investments in Rural Infrastructure

A number of micro level studies have investigated how a greater investment in infrastructure raises agricultural productivity. But infrastructure investments have many effects. As long as the majority of rural households are dedicated to more than one income activity, whether salaried or non-salaried, agricultural or non-agricultural, it is not abnormal that the access to public infrastructure will also affect household labour assignments (diversifying livelihoods). One study, for example found for Tanzania a significant increase in non-agricultural activities as a consequence of a better infrastructure in roads (Lanjouw *et al.*, 2001). This diversification could be the product of the necessity to hedge against unanticipated risks in a context where credit and insurance markets malfunction or are not existent (Zimmerman and Carter, 2003; Ellis *et al.*, 2003). Alternately the result could be due to the existence of entry barriers that prevent access to more profitable labour markets due to insufficient public or private assets (Reardon *et al.*, 2001). In either of the two cases, the access to public infrastructure could have a direct or indirect role increasing the income generating opportunities for the poorest rural populations. Infrastructure development also opens up the rural economy to greater competition from outside. This may take the form of cheaper products from lower-cost sources of supply or new or improved products that may displace some locally produced items. Some traditional rural and cottage industries lose their markets, but other types of activities expand and prosper (Jayaraman and Lanjouw, 1998).

In summary, the majority of studies recognise that infrastructure investment has a strong impact on rural incomes and especially on smallholders. However, this literature has not been completely successful in assessing the benefits and costs of

alternative infrastructure investment options or the causality of relations that generate higher rural incomes due to a better endowment of infrastructure services. The work carried out by Fan and others (Fan and Hazell, 1999; Zhang and Fan, 2000; Fan *et al.*, 2000; Fan *et al.*, 2000 and Fan *et al.*, 2002) in India and China are some of the few studies that look into the relationships between investment in infrastructure, rural growth, poverty alleviation and the role of complementarities of investments. The problem with the lack of causal relationship knowledge between the investment in infrastructure services and the increase of income generating opportunities and welfare benefits of rural populations is that the possibility of developing specific policy recommendations is very limited. This problem normally results in policy recommendations that are directed towards a general increase in public infrastructure investment but lacks opinions about appropriate intervention strategies for each specific context. In the light of this, and with the scarce public fiscal resources available in developing countries, knowing the relative profitability of each type of public infrastructure is critical. Likewise, it is essential to understand the principal mechanisms that stimulate changes in the livelihoods of rural inhabitants as a result of a determined increment in rural infrastructure services.

Improvement in rural roads effect agricultural development followed by the development of social services. It is observed that roads tend to have a greater initial impact on the production where cash crops are grown, because food crops, grown by small farmers have a lower price elasticity of supply than cash crops (USAID, 1972). A study of the socio-economic improvement, with roads, on the village development, based on a survey of 1662 villages in India, found that the effect of accessibility was greater for unimproved than for improved roads suggesting that in bringing about socio-economic change, existence of some kind of trafficable route is of major importance. Its quality is a second-order consideration (Bansal and Patil, 1979). In another study macro data was used from 85 random selected districts of India to examine the role of rural roads, among other factors in agriculture investment and output. The study found that the road investment contributed directly to the growth of agricultural output, increased use of fertiliser, expansion of commercial banking operations, etc. (Binswanger *et al.*, 1993).

There was also an observation regarding the positive impact of social development and irrigation intensity factors on the composite index of economic development at the district level (Gulati, 1997). Within the social development factors, the surfaced road length and electricity turned out to be the crucial infrastructure. In a state level analysis for two periods of time, viz., 1970-71 and 1980-81, the inadequacy of infrastructure facilities has been observed as a major obstacle in the path of progress of developing states. It was observed that infrastructure had a positive impact on development, at least in six states while in another five, low development levels were associated with poor infrastructure development (Tewari, 1984). Another study for a recent period found positive and significant relationship between the level of infrastructure and per capita net state

domestic product between 1971-72 and 1994-95 (Ghosh and De, 1998). A positive correlation was also observed between infrastructure and agricultural development. Among the various infrastructure facilities, agricultural development was strongly correlated with agricultural infrastructure index followed by index of transport and communication (Singh, 1983).

On the basis of a regression analysis and state level cross-section data for each of the years from 1971-1995 a study indicated that among various physical infrastructures, it was transport infrastructure that significantly affected the agricultural output level and the agricultural development index. However, besides physical infrastructure, social infrastructure also had significant positive impact on the dependent variables. At the district level, from the regression analysis, at three points of time, viz., 1971, 1981 and 1991, the study observed that agricultural and transport infrastructure are important determinants of agricultural output and agricultural development index (Majumdar, 2002).

A recent study attempted to analyse the impact of infrastructure on agriculture development using larger data, both in terms of time period and coverage of infrastructure variables to include ten explanatory variables. The results indicate that transport, power, irrigation and research infrastructure are four critical components that affect the agricultural productivity in a significant manner. With improvement in access to power, irrigation infrastructure also improved, particularly through energisation of pumpsets. In turn, improved irrigation facilities, coupled with research input enhanced agricultural productivity. The other infrastructure facilities like access to fertiliser sale points, markets, credit infrastructure, extension services, etc. were also developed with development of transport infrastructure (Thorat and Sirohi, 2002).

Growth of Rural Infrastructure in India Since Independence

The Government has traditionally been well aware of the fact that the availability of adequate infrastructure facilities is vital for the acceleration of economic development of a country. At the time of Independence, the government has accepted the crucial role played by infrastructure in the development process of the country and also realised that given the long gestation of infrastructure projects and their generally low profitability, private capital is unlikely to flow into the infrastructure sectors and hence the responsibility was shouldered by the public sector and infrastructure development became the domain of the state. Consequently, in the Five Year Plans, priority was accorded to investments in sectors such as power, transport, communication, etc.

The First Five Year Plan recognised that large areas of the country have remained underdeveloped due to the lack of basic services like transport, communication, irrigation and power and this Plan attached priority to agriculture including irrigation and power. The Plan sought that agricultural development receives the highest

precedence that necessitates an extensive programme of investment covering minor as well as major irrigation projects. Generation of electricity and power that is linked in most places to the major investment projects was also a high priority in its own right. In regard to transport also, public authority has a special responsibility. The State has to take further initiative in linking up the whole country through the system of roads reaching down to the village (Thorat and Sirohi, 2002).

But in the sixties, while the Plans continued to emphasise the infrastructure development, there were no matching financial outlays for these sectors. However, infrastructure development continued to be an important element from the Indian policy perspective and the Sixth Five Year Plan, reiterated the need for massive public investment in rural infrastructure and ensuring that the fruits of economic progress are more equitably distributed in rural areas. The Plan clearly ones ized that altering the new projects in favour of quick maturing and directly productive projects, may improve the short term prospects, but would adversely affect the long term growth rate, as such a choice leads to less investment in long gestation infrastructure projects (Government of India, 1981). The Eighth Five Year Plan re-emphasised rural infrastructure development and considered it to be one of the basic elements of an employment-oriented growth strategy. Strengthening the infrastructure (energy, transport, communication, irrigation) in order to support the growth process on a sustainable basis was one of the explicit objectives that was to be accorded priority in the Plan. Besides, the development of physical infrastructure, the Plan also ones ized that social infrastructure is to be attended to with a degree of urgency in the next phase of development (Government of India, 1992).

With the large-scale plan expenditure of the government, the availability of infrastructure has significantly expanded in the country over the years. The growth in the stock of major infrastructure items in India has been shown in Table 1. Important physical items of infrastructure significantly influencing production and growth in agriculture have grown in the period. Equally important increase is in the marketing infrastructure including roads and transport, storage and market facilities which provide impetus to agricultural production growth through orderly disposal. Similarly the number of regulated markets in the country has also increased (Bhatia, 1999).

TABLE 1. ALL INDIA EXPANDED STOCK OF INFRASTRUCTURE

Year (1)	Power generation (bln kwh) (2)	Irrigated area (mln ha) (3)	Fertiliser production (lakh ones) (4)	Road length (‘000 kms) (5)	No of commercial vehicles (lakh) (6)	No of regulated wholesale markets (7)	No of Registered medical practitioners (‘000) (8)
1950-51	5.1	22.56	0.5	400	1.16	206	61.39
1960-61	16.9	27.98	1.5	524	2.25	715	83.46
1970-71	55.8	38.19	10.50	918	4.37	1777	153.50
1980-81	110.8	49.73	30.08	1491	7.01	4158	266.49
1990-91	264.3	62.47	90.45	2037	17.44	6250	397.76
1995-96	380	70.25	117.03	2884	22.21	6836	491.40

Source: Bhatia (1999).

The inverse relationship between poverty and backwardness on one hand and Infrastructure Development Index (IDI) on the other is well established as seen from Tables 2 and 3.

TABLE 2. RELATIONSHIP BETWEEN POVERTY INDICES AND LEVELS OF IDI

Poverty Level (1)	No. of Regions (2)	IDI level		
		High (3)	Medium (4)	Low (5)
High	19 (100.0)	-	4 (21.1)	15 (78.9)
Medium	19 (100.0)	5 (25.3)	6 (31.6)	8 (42.1)
Low	19 (100.0)	9 (47.4)	7 (36.8)	3 (15.8)
Total	57 (100.0)	14 (24.6)	17 (29.8)	26 (45.6)

Source: India Rural Development Report 1999, NIRD.
Figures in parentheses are percentages.

TABLE 3. STATES WHERE MORE THAN 40 PER CENT REGIONS FALL IN BOTTOM 30 PER CENT FOR INFRASTRUCTURE RANKING

State (1)	No. of Regions (2)	Electricity (3)	Post and Telegraph (4)	Roads (5)	Gross Irrigated Area (6)	Backwardness Index (per cent) (7)
Uttar Pradesh	5	4	4	5	-	65.0
Rajasthan	4	3	3	4	-	62.5
Madhya Pradesh	7	1	3	7	4	53.6
Meghalaya	1	1	1	-	-	50.0
Bihar	3	3	2	-	1	50.0
Assam	3	3	1	1	1	50.0
Orissa	3	3	1	-	2	50.0

Source: India Rural Development Report 1999, NIRD.

The states with predominant deficiency in infrastructure in four prominent sectors are indicated in Table 4.

TABLE 4. STATES WITH PREDOMINANT DEFICIENCY IN INFRASTRUCTURE

Sl. No. (1)	Sector (2)	States (3)
1.	Electricity	Assam, Bihar, Orissa, Rajasthan, Uttar Pradesh, West Bengal, Meghalaya
2.	Posts and Telegraph	Arunachal Pradesh, Bihar, Rajasthan, Uttar Pradesh, Meghalaya
3.	Road Density	Madhya Pradesh, Rajasthan, Uttar Pradesh
4.	Gross Irrigated Area	Maharashtra, Madhya Pradesh, Kerala, Orissa, Assam

Source: India Rural Development Report 1999, NIRD.

The study by Bhatia also examines the relationship between infrastructure and agricultural output. The state wise index of infrastructure, per hectare yield of foodgrains and value of agricultural production for 1994-95 are indicated in Table 5.

It can be observed from the Table that Punjab which has the highest index of infrastructure also has the highest yield of foodgrains and value of agricultural production per hectare. Tamil Nadu and Haryana which have the second and third highest index of infrastructure, have third and second highest yield per hectare of foodgrains. Rajasthan and Madhya Pradesh which have a very low index of infrastructure also have a low yield of foodgrains and total value of agricultural production per hectare (Bhatia, 1999).

TABLE 5. STATEWISE INDEX OF RURAL INFRASTRUCTURE, YIELD OF FOODGRAINS AND VALUE OF PRODUCTIVITY PER HECTARE

Sl. No. (1)	State (2)	Index of Infrastructure (3)	Yield of foodgrains per hectare (kg) (4)	Value of output per hectare (Rs.) (5)
1.	Andhra Pradesh	53.6 (X)	1713 (VII)	4089 (XI)
2.	Assam	50.8 (XI)	1308 (XI)	5402 (VIII)
3.	Bihar	42.0 (XV)	1446 (X)	4091 (X)
4.	Gujarat	55.6 (VII)	1249 (XII)	2062 (XVII)
5.	Haryana	65.9 (IV)	2730 (II)	7288 (IV)
6.	Himachal Pradesh	56.6 (VI)	1643 (VIII)	6797 (V)
7.	Jammu and Kashmir	53.9 (IX)	1632 (IX)	6696 (VI)
8.	Karnataka	56.8 (V)	1152 (XIV)	3368 (XII)
9.	Kerala	70.0 (II)	1873 (VI)	8088 (II)
10.	Madhya Pradesh	42.0 (XV)	1088 (XV)	2180 (XV)
11.	Maharashtra	54.4 (VIII)	852 (XVII)	2275 (XIV)
12.	Orissa	47.9 (XIV)	1231 (XIII)	2765 (XIII)
13.	Punjab	85.3 (I)	3684 (I)	9133 (I)
14.	Rajasthan	38.3 (XVI)	906 (XVI)	2109 (XVI)
15.	Tamil Nadu	68.4 (III)	2358 (III)	5204 (IX)
16.	Uttar Pradesh	50.1 (XIII)	1932 (V)	5744 (VII)
17.	West Bengal	50.4 (XII)	2077 (IV)	7798 (III)

Source: Bhatia (1999).

Figures in parentheses are rankings.

Despite the creeping commercialisation of infrastructure provision services, there has been a realisation that the State has to continue playing a major role in strengthening the physical infrastructure. There is also an increasing understanding on the part of the State about the social dimension of infrastructure and the State continues to bear the responsibility of providing the poor with adequate access to basic services such as health, education, water supply, sanitation and sewerage. With these objectives in view the Government of India continued to implement specific infrastructure strengthening programmes in sectors like irrigation, rural electrification, rural connectivity and rural drinking water supply.

The Accelerated Irrigation Benefit Programme (AIBP) was launched by the Central Government in 1996-97 for accelerating implementation of ongoing irrigation/multi-purpose projects. Under the programme 45 major/medium irrigation projects have been completed creating an additional irrigation potential of 3.25 million hectares. 3,179 minor irrigation schemes have been completed creating an irrigation potential of 1.21 lakh hectares. Under the scheme for repair, renovation and

restoration of water bodies directly linked to agriculture pilot projects have been launched in 23 districts of 13 States with an estimated cost of Rs. 262.91 crores. Irrigation is one of the six components for development of rural infrastructure under 'Bharat Nirman'. The irrigation component of Bharat Nirman aims at creation of irrigation potential of 10 million hectares in the four period of 2005-06 to 2008-09 (Government of India, 2006).

The Rajiv Gandhi Grameen Vidyutikaran Yojna (RGGVY), a scheme for rural electricity infrastructure and household electrification was launched in 2005-06 to achieve the objective of providing access to electricity to all rural households over a period of four years. The scheme envisages 90 per cent capital subsidy for setting up of rural electrification infrastructure which will cater to the requirements of agriculture and other activities, including irrigation pumpsets, small and medium industries, khadi and village industries, cold storage chains, healthcare, education and rural IT. Unelectrified BPL households will get electricity connection free of charge in all rural habitations (Government of India, 2006).

The Pradhan Mantri Gram Sadak Yojana (PMGSY) was launched in 2000 as a 100 per cent central subsidy scheme to provide all-weather connectivity to all eligible unconnected rural habitations. Bharat Nirman envisages connectivity by 2009 to all habitations with a population of 1000 or more in the plains and of 500 or more in the hilly, desert and tribal areas. The systematic upgradation of the existing rural road network also is an integral part component of the scheme. The Accelerated Rural Water Supply Programme (ARWSP), in operation since 1972-73, is now being implemented as a part of Rajiv Gandhi National Drinking Water Mission. It aims at coverage of all rural habitations with population of 100 and above, specially the unreached areas, ensure sustainability of systems and sources and tackle the problem of water quality. Drinking Water Supply is one of the six components of Bharat Nirman under which it has been envisaged to cover 55,067 uncovered habitations and also to address the problems of slippages and water quality (Government of India, 2006).

Creation of Rural Infrastructure Development Fund (RIDF)

In the context of the need for stepping up agricultural growth rate to 4.5 per cent in the Ninth Five Year Plan, emphasis was considered necessary for developing rural infrastructure in sectors like irrigation, roads, bridges, etc. as an essential requirement for better productivity of capital and labour. However one of the basic limitations to create adequate infrastructure was the lack of resources. Difficult financial position of the state governments, who are mainly responsible for development and maintenance of rural infrastructure, was a cause for concern. This apart it was found that the commercial banks who were expected to channelise 18 per cent of their total lending to agriculture were not able to fulfill their commitment. It was therefore considered desirable to create a fund out of the shortfall in commercial banks' lending for

agriculture in the name of Rural Infrastructure Development Fund (RIDF) to be operationalised by NABARD. Government of India announced this fund in the Budget of 1995-96 aimed at financing on-going rural projects in the area of basic infrastructure like agriculture, production, transport, marketing and other allied activities. The then Finance Minister, in his budget speech, declared "Inadequacy of public investments in agriculture is today a matter of general concern. This is an area which is the responsibility of the states and many states have neglected investments in infrastructure for agriculture. There are many rural projects which have been started but are lying incomplete for want of resources. They represent a major loss of potential income and employment to rural population"(Government of India, 1995).

RIDF was set up within NABARD as a lending facility for State Governments. It was set up with an initial amount of Rs. 2,000 crores primarily to provide financial assistance to State Governments in ensuring speedy completion of projects which could not be completed due to paucity of funds with concerned agencies, the coverage of the scheme is being extended in successive budgets. A significant number of projects covered in the rural areas are, major, medium and minor irrigation, rural roads, bridges, watershed management, rural market yards, Command Area Development, drainage, cold storages, primary health centres, primary schools, rural drinking water supply projects etc. With an allocation of Rs. 2,000 crores under RIDF I, in 1995-96, the Fund has reached the level of Rs. 10,000 crores under RIDF XII taking the cumulative corpus to Rs. 60,000 crores during 2006-07. In addition, Rs. 4,000 crores has been separately allocated for rural roads under Bharat Nirman. Bulk of the investments made in the case of rural infrastructure has been shared between irrigation (38.78 per cent) and rural roads (40.1 per cent) followed by rural bridges (13.2 per cent) leaving only 8 per cent for other infrastructure activities such as watershed development, flood protection, market yard development, cold storages, fisheries, forest development, soil conservation, rural drinking water supply etc.

The Fund has been lending every year in tranches and each tranche targeted a specific corpus. Project proposals are invited from State Governments and sanctions are made within a specified corpus for new or ongoing projects in minor, medium and major irrigation along with flood protection, watershed management and soil conservation etc. In addition to these activities, the following were added subsequently: Rural roads and bridges; Rainwater harvesting; construction of terminal market yards; fishing jetties and cold storages; primary school buildings; primary health centres; village haats; forest management; mini-hydel and system improvement projects; rural drinking water supply projects and citizen information centres under IT. In the first four tranches of RIDF loans were sanctioned exclusively to the State Governments, while from the Vth tranche onwards, the coverage has been extended to include and execution of projects of Panchayati Raj institutions, SHGs and NGOs.

The loans from the fund are project based. The project proposals received from the State Governments are appraised for technical feasibility, financial viability and

economic and social benefits. The rate of interest on lendings to state government is at 0.5 per cent above the prevailing bank rate and is at present at 6.5 per cent. Under each tranche normative allocation is made to the states on the basis of rural population, geographical area, infrastructural development index and implementation of past projects. The cumulative sanctions and disbursements under RIDF are indicated in Table 6.

TABLE 6. CUMULATIVE SANCTIONS AND DISBURSEMENTS UNDER VARIOUS TRANCHES
(AS ON 31 MARCH 2006)

RIDF Tranche (1)	Corpus (2)	No. of projects (3)	Amount (Rs. crores)			Per cent of disbursement** (7)
			Sanctioned (4)	Phased (5)	Disbursed (6)	
I	2,000	4,168	1,906.21	1,906.21	1,760.87	92.4
II	2,500	8,334	2,666.87	2,666.87	2,397.95	89.9
III	2,500	14,346	2,733.82	2,733.82	2,453.50	88.9
IV	3,000	6,172	2,903.32	2,903.32	2,482.00	85.5
V	3,500	12,254*	3,477.16	3,477.16	3,032.66	87.2
VI	4,500	43,354	4,525.36	4,525.36	3,850.83	85.1
VII	5,000	24,987	4,657.65	4,657.65	3,756.82	80.7
VIII	5,500	21,012	6,009.36	6,009.36	4,440.34	73.9
IX	5,500	19,605	5,599.18	5,599.18	3,387.48	60.5
X	8,000	59,979	8,289.75	6,878.48	2,967.81	43.1
XI	8,000	30,440	8,514.33	3,033.30	807.08	26.6
Total	50,000	2,44,651	51,283.01	44,390.71	31,337.34	70.6

Source: NABARD (2006).

*One lakh STWs sanctioned to Government of Assam treated as single project; **With phased amount.

Impact Evaluation of RIDF Projects

NABARD conducts evaluation studies on a continuous basis to assess the socio-economic impact of investments under RIDF. These findings, though limited by methodological variations, locational differences, price differentials etc, throw-up valuable insights into the levels of benefits derived by the farmers. It has been estimated that projects funded under RIDF would facilitate the expansion of the production base in rural areas and create additional employment opportunities as indicated in Table 7.

TABLE 7. ACCRETION TO RURAL INFRASTRUCTURE AND EMPLOYMENT

(lakh)	
Rural Infrastructure (1)	(2)
Additional irrigation potential	107.92 ha
Rural road network	2.02 km
Rural bridges	3.69 mt.
Generation of employment	
Due to increased irrigation	
-Recurring (jobs)	50.62
-Non-recurring (person days)	15,417
From non-irrigation projects-	
Non-recurring (person days)	28,348

Source: NABARD (2006).

Five studies sponsored by NABARD conducted on irrigation projects under RIDF in various states have shown various positive impacts of RIDF such as on small farmers coverage, contribution to capital costs, expansion of irrigable and irrigated commercial area, enhanced cropping intensity, incremental income, higher financial rate of return and employment generation. It has been estimated that irrigation projects financed under RIDF I to VIII have created irrigation potential of 75.06 lakhs ha and generated recurring employment of 39.84 lakh jobs per annum (NABARD, 2004).

As far as road projects are concerned, the studies conducted by NABARD observed that RIDF investments have led to improvement in access to modern agri-economic practices, improved accessibility in case of participation, increased frequency of extension staff, etc. The net benefit from investments under rural roads per month was in the range of Rs. 2.08 lakh in Gujarat to Rs. 2.87 lakh in Tamil Nadu. Employment availability in terms of man-days per year increased by 35 per cent in case of Punjab and 8 per cent in case of Rajasthan. Economic rate of return of the investments calculated in DCF technique ranged between 20.2 per cent in case of Tamil Nadu to 36.2 per cent in case of Gujarat. The study also observed positive changes in intangible benefits due to development of rural roads. There were changes in asset holding patterns, increase in job availability, increased credit absorption, improvement in access to education and health, improved quality of life etc. Credit absorption in the project area increased by 163 per cent in Tamil Nadu and by 30 per cent in Punjab. Significant change in enrolment to primary schools was observed in states covered in the study. Improved connectivity on account of construction of bridges has resulted in reduction of transportation costs of farm inputs and outputs, vehicle operating costs, travel time, etc. (NABARD, 2004).

A monitoring study on Kharkhara Mohdipat Irrigation Project in Chhattisgarh revealed that efforts were made to link the available water resources including the existing old tanks under the project command area by remodeling the canal system and extending their tails so as to cover maximum area thereby reducing cost of land acquisition. The study on Bisalpur Multi-purpose project in Rajasthan revealed that there were time and cost overruns in both phases (I and II) of the project. The irrigation facilities extended has brought about positive changes in the cropping intensity and productivity. There has also been an improvement in farm mechanisation, especially in the use of tractors and threshers. The project paved way for establishment of ITC's e-choupal network for the sale of farm inputs and purchase of outputs and also allied activities such as dairy and bee-keeping units (NABARD, 2006).

FINANCING RURAL INFRASTRUCTURE: BEYOND RIDF

Financing of the creation of rural infrastructure through the medium of RIDF has entered its twelfth year in 2006-07. However it has to be realised that RIDF is

basically dependent on a negative incentive system- the non achievement of priority sector and agriculture lending norms by commercial banks. This implies that if the performance of the commercial banking sector measures up to the demands placed upon them and they are able to fulfill the priority sector and agriculture lending norms no resources would be available for RIDF. But irrespective of the source of funds, the RIDF mechanism would have to continue in view of the comfort levels it has afforded to the State Governments in creating rural infrastructure. In such a scenario Government of India, RBI and NABARD have to explore the alternative sources of finances for RIDF.

If this trend towards raising non-budgetary resources for infrastructure is to continue, financial markets will have to respond by providing the necessary long-term resources. Both foreign and domestic sources of capital will need to be tapped. Reliance on foreign savings remains a necessity due to the lack of depth in local debt markets. Worldwide, capital markets contribute to the major share of funding for infrastructure development. But with lack of markets for long-term funds India is starved of long-term capital, which is a necessary condition for infrastructure development. Deepening of capital markets will go a long way in addressing this issue. Insurance companies, provident funds and pension funds should be enabled to commit more of their funds which are basically of a long term nature to financing infrastructure, especially rural infrastructure. It stands to reason that NABARD should have greater access to these resources and its debt instruments should be given the requisite infrastructure tag for tax benefits.

PUBLIC-PRIVATE PARTNERSHIP IN INFRASTRUCTURE PROVISION

The recent years has also shown a perceptible shift in government approach to infrastructure development. Concerns were raised about escalating costs and inefficiencies in infrastructure projects. It was recognised that due to lack of cost consciousness and subsidising of infrastructure facilities to the consumers, projects and services were unable to generate the resources required for their own maintenance and expansion, let alone producing a surplus for the others. Hence, private initiative was sought to be encouraged in creating infrastructure and the area that was hitherto considered to be solely in public domain. Apart from the tight fiscal situation, the increasing need to provide an efficient infrastructure in a globally competitive set up, rethinking on the ability of the government owned entities to supply quality infrastructure have also been instrumental in privatisation of infrastructure services. Thus, in the current context, while the government continues to remain the service provider in the infrastructure sector, it needs to facilitate private investment in infrastructure as much as possible.

Taking cognisance of the advantages that Public Private Partnership (PPP) offers in terms of cost saving, access to specialised expertise and proprietary technology, sharing of risks with private sector and the ability to take up a larger shelf of

infrastructure investments, Government of India is actively encouraging them. The shift towards PPPs is primarily driven by the inadequacy of budgetary resources. However, an enlarged role of PPPs also provides an opportunity to introduce competitive suppliers of infrastructure services leading to improvement in the quality and services and reduction in costs. PPPs also ensure the sparing of sparse public resources for other sectors where private sector would be reluctant to go. To create an enabling milieu to improve predictability and mitigate risks for PPPs and prune transaction costs and time, the Government has to foster an institutional mechanism, besides modernising the policy and regulatory framework.

Small-scale Community Based Infrastructure

In the context of overall infrastructure-poverty reduction-governance nexus, small-scale community based infrastructure assumes a special place as it may present more insights into the issues involved. Because of the nature, location, design and implementation process, small-scale infrastructure may bring more direct impacts on the lives of poor people. Small irrigation projects contribute immediately to agricultural productivity bringing tangible benefits to the small farmers. A rural feeder road improves mobility of the local communities and reduces transportation costs which have impacts on economic activities. Further local communities can take part directly in decisions regarding the nature of the infrastructure, location of facilities and designs. They can also take part in the implementation process and be involved in operation and maintenance of facilities. Small-scale infrastructure helps to reinforce social capital and consolidate community organisations. The small-scale community based infrastructure efforts are complementary to large-scale infrastructure initiatives in many ways. First, small-scale infrastructure fills in the gaps left by large scale projects mostly designed from the top down. Second there are complementarities between large scale and small-scale infrastructure. Third, some of the governance lessons from small scale community based projects may be replicated and scaled up in large scale infrastructure (Jahan and McCleery, 2005).

ISSUES FOR POLICY DEBATE

There is an increasing consensus that providing adequate infrastructure is an important step in the process of poverty alleviation and in providing a more equitable set of opportunities for rural areas by linking small and marginal farmers to the markets, and by reducing the market risk and transaction costs they face. However in this endeavour there are several policy issues that require further attention and debate. These issues could be discussed under the following broad heads:

Governance Related Issues: In view of the huge extent of resources involved in infrastructure projects, governments the world over have to prioritise. An overarching

policy issue is to apply benefit-cost analysis to rank alternative infrastructure investment strategies and projects. With limited public resources, several countries in the developing regions are undertaking important reform processes in order to promote private investment in the provision of infrastructure. But along with these reforms governments have to develop robust mechanisms for ranking alternatives in infrastructure investments.

The intended benefits from investments in infrastructure cannot be reaped unless infrastructure is managed properly—from the design and location decision to implementation to operation and maintenance. All these issues interact with each other in a mutually reinforcing way and in this linkage governance plays a major part. Governance of infrastructure requires institutional reforms and capacity development. First, with improved governance, there is an increased efficiency in resource use, with less waste in the form of leakages and corruption. Second, with better governance, efficiency in service delivery also improves. This maximises the effects of infrastructure. Third, better governance also ensures transparency and accountability. Furthermore, governance plays a major role in the scaling up process of the infrastructure.

In order for public goods to be provided, the amount and type of infrastructure to be supplied must be decided, investments must be made and infrastructure provided, and the infrastructure facilities must be maintained. The market would clearly fail in these functions, but centralised public infrastructure bureaucracies have not proved adept at performing them either. In most situations, infrastructure provides public goods of a localised nature. Decentralised responsibility offers an opportunity to improve the provision of such goods. Further, the poor use fewer infrastructure services than the non-poor, not only because of low incomes but also because of low access. Failure to reach the poor has often been associated with flawed infrastructure pricing policies and little emphasis on the services of most value to them, for which they are willing to pay.

The importance of participation in the effective delivery of local public goods is well recognised, and it is central to community provision of services. It is particularly important to ensure that participatory processes involve all groups of beneficiaries, including women and others who may be disenfranchised, such as the very poor and landless. Reaching consensus on user needs often leads to infrastructure that is lower in cost, less technologically complex, and more labour intensive. Another policy issue is whether the reform processes in infrastructure provision will have the benefits expected. If reform is to be successful, one has to address the widening disparities between those benefiting from reforms and those rural areas where the costs, the lack of information, or the risk prevents public participation.

Structural and Operational Issues: The indicator of inefficient performance by an infrastructure system is the extent of output lost in delivery. Distribution losses in water and power supply systems are the prominent examples. Inefficient use of

labour is especially common and costly in infrastructure. At the same time, in construction and maintenance of rural infrastructure, often equipment-based methods are used rather than employment intensive methods that can produce high quality results, while being more consistent with relative capital and labour costs.

Closely related to operational inefficiencies is lack of maintenance: roads deteriorate, irrigation canals leak, water pumps break down, sanitation systems overflow, installed phone lines fail. Capacity is then lost, output declines and substantial additional investment is needed simply to sustain existing levels of service. In road sector, inadequate maintenance imposes large recurrent and capital costs. Neglect of routine maintenance can compound problems to such an extent that the entire surface of a road has to be replaced. Maintenance expenditures are often not allocated by economic priorities. In irrigation, too, poor maintenance is costly and results in distribution channels being filling up with silt and weeds, canal linings cracking at an increasing rate, and outlets breaking or being bypassed. Inadequate maintenance is a problem in rural water supply and power sector also. Sometimes problems of operation and maintenance are rooted in the initial design or construction of infrastructure.

Finance Related Issues: Infrastructure must be conceived of as a 'service industry' providing goods that meet customers' demands. Successful providers of infrastructure services in public or private sector are generally run on business lines and have three basic characteristics: They have clear and coherent goals focused on delivering services; their management is autonomous, and both managers and employees are accountable for results; and they enjoy financial independence. Government and public sector remain the dominant players in the provision of infrastructure services. Therefore improving the effectiveness of public sector infrastructure providers is critical. It can be done by applying three core instruments to reinforce commercial operations in the public sector:

- Corporatisation, which establishes the quasi-independence of public entities and insulates infrastructure enterprises from non-commercial pressures and constraints.
- Explicit contracts between governments and managers or entities involved in infrastructure services, which increase autonomy and accountability by specifying performance objectives that embody government defined goals
- A pricing strategy designed to ensure cost recovery, which creates a desirable form of financial independence for public utilities and even at times for public works.

An element in the successful provision of infrastructure on a commercial basis is the establishment of reliable revenue sources that give providers more financial

autonomy. Reliance on revenues directly related to services delivered will increase the productivity of infrastructure suppliers and also often benefit users.

FURTHER RESEARCH AGENDA

Even though researchers recognise that the externalities resulting from infrastructure investment play a central role in rural development and poverty alleviation there is a need for greater empirical research in the area. Existing empirical evidence that substantiates these arguments at the microeconomic level is too limited. As such future empirical work to analyse rural households with different levels of access to public goods and services should allow for the study of the presence and importance of these externalities.

Research has to identify investment opportunities that generate the largest multiplier effects and that enhance the attraction of public and private investments for the rural sector and also identify methodologies to raise the private and social profitability of the executed investments. There is a need to enhance knowledge levels about the impact that complementary investments in rural infrastructure may have on market development and on reducing poverty.

Social cost benefit analysis is often advocated as a device for clarifying, rationalising and simplifying societal choices and avoiding social conflict, while taking investment decisions in infrastructure. But there have been arguments that this technique does not clarify but rather obscures rational deliberative processes involving plural values, faces intractable difficulties regarding predictability, discount rates and opportunity costs and is based on a controversial political theory. There is thus a need to evaluate social cost benefit analysis as a tool for infrastructure investment decision making.

The absence of reliable data bases at the regional level reduces the scope for empirical testing. Data collection and dissemination at the regional level needs to be high on the research agenda. The availability of public investment and private investment data at the district level would be useful for examining intra-state as well as inter-state growth effects. Researchers could include the concepts of theoretical spatial economics and spatial econometrics in their empirical studies. Presently most of empirical work is in simple uni-directional causal model that does not appear to capture the multiple impact path-potentials between infrastructure and growth. There also appears to be an issue of appropriate aggregation levels. In addition to being sensitive towards scale and spatial issues, model specification and development of conceptual linkages are central to further work on infrastructure productivity (Lall, 1999).

Future research has also to estimate the existing complementarities between the different types of public infrastructure and the endowments of private assets (human capital, financial-physical capital or social capital), which are already possessed by rural populations, in order to maximise the impact of public infrastructure investment.

Research should also facilitate the design of strategies to provide institutional arrangements for the adequate access to public infrastructure needed to enhance the environment in which private sector activities take place. Specifically, there is a need to address the issues concerning how to foster institutional innovations to enhance infrastructure investments. Concurrently, the identification of bottlenecks (physical or institutional) which impede the attainment of maximum potential for investment in rural infrastructure services should also form a major part of research agenda.

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