

Impact of Road Infrastructure on Agricultural Development and Rural Road Infrastructure development programmes in India

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ABSTRACT: Agriculture plays an essential role in the process of economic development of less developed countries like India. Besides providing food to nation, agriculture releases labour, provides saving, contributes to market of industrial goods and earns foreign exchange. Agricultural development is an integral part of overall economic development. Road transport plays an important role in agricultural development. This is because it is the major means of transporting agricultural produce from the farms to the markets as well as to various urban communities. Development of road infrastructure is imperative for agriculture and overall economic growth as also improving the quality of life. Better roads can reduce transaction costs associated with agricultural activities and in so doing have the potential to reduce the costs of acquiring inputs, to increase output prices, and to permit entry into new and more profitable activities. Governments frequently are involved in other dimensions of agricultural activities, and there is an a priori strong case for governments to undertake these investments given the public goods nature of roads. Public investments can play several roles in creating the enabling environment necessary to stimulate agricultural growth.

Keywords: Road infrastructure, Transportation, Agricultural Production & Road connectivity

I. INTRODUCTION

The economy of India is predominantly agrarian in nature. Regardless of prompt growth in other sectors, agriculture and allied sectors still the major sector contributing 16 percent towards the Gross Domestic Production (2014-15). About two third of the total population of the country lives in rural areas which are directly or indirectly allied with agriculture. According to estimates agriculture sector has occupied about 53 percent of total labor force and its direct and indirect contribution in annual exports of the country is around 23percent. Indian agriculture is characterized by lack of proper infrastructure facilities. As far as nature of infrastructure is concerned, agricultural infrastructure plays an important role especially in a developing country context where a larger percentage of poorer section of the society depends on this sector for subsistence. The enhancing infrastructure warrants a closer relationship between the levels of agricultural development.

Among agricultural infrastructure road infrastructure plays a very significant role in accelerating agricultural production. Rural Roads Connectivity is one of the key components for rural development, as it promotes access to economic and social services, generating increased agricultural income and productive employment. About 600 million people of India live in nearly 6 lakh villages scattered all over the country. Access roads provide the means to bring the rural population on to the main stream. A good road network reduce transport cost, accelerates efficient delivery of farm inputs and enhance special agricultural production and distribution. A good network of roads will expand the distribution of agricultural goods as well as open up additional opportunities for agricultural trade (Inoni 2009). Good infrastructure leads to expansion of markets, economies of scale and improvement in factor market operations. It also opens up the rural economy to greater competition. 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. The majority of studies recognize that infrastructure investment has a strong impact on rural incomes and especially on small holders. 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 entrepreneurship activity, sharp decline in freight and passenger charges and improved services as a result of investment in rural roads (Bonney, 1964). Road are always recognized as an infrastructure and arteries of the nation. Rural infrastructure assumes great importance in India because of the country's predominantly rural nature.

Rural roads were not only providing connectivity to rural area but also affecting change in cropping pattern due to access to markets, increasing productivity by facilitating availability of inputs like seeds, fertilizer and pesticides, realization of better prices to the farmers for agriculture and allied products like milk, improving attendance in schools and above all opening new employment opportunities in non-farm and service sectors (Sangwan S S, 2010).

The rural road in India forms a substantial portion of the Indian road network. These roads are in poor shape, affecting the rural population's quality of life and Indian farmer's ability to transfer produce to market post-harvest. Over 30 percent of Indian farmer's harvest spoils post-harvest because of the poor infrastructure. Many rural roads are of poor quality, potholed, and unable to withstand the loads of heavy farm equipment. These roads are also far from all season, the total length of rural road is of the order of 2.7 million kilometers in 2001 and which is 3.1 million kilometers in 2011. Of which 1.2million kilometers Paved, not maintained rural roads and 1.9 million kilometers of unpaved rural roads.

II. LITERATURE REVIEW

A study in Thailand by **Moore (1980)**, revealed that impact of roads was more on isolated areas that were brought into the mainstream. The area under cultivation and the intensity of land use increased significantly wherever access to markets is improved.

A study of the socio-economic impact of roads on village development by **Bansal and Patil (1979)** 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, the existence of some kind of trafficable route is of major importance, its quality is a second-order consideration. In their study, Hans Binswanger et.al (1989), used macro data from eight-five randomly selected districts of India to examine the role of rural roads, among other factors, in agricultural investment and output. The study found that road investment contributed directly to the growth of agricultural output, increased use of fertilizer, expansion of commercial bank operations, etc. The study by IFPRP on a survey of 129 villages in various parts of Bangladesh categorized the villages into two groups based on an aggregate index developed to reflect the ease of access of a village to various services such as markets, schools, banks, and local administrative offices. Villages with better access were found to be significantly better off in a number of areas including agricultural production, household incomes, wage income of landless labour, health, and the participation of women in the economy.

Gulati (1997) observed a positive impact of 'social development' and irrigation intensity factors on the composite index of economic development, at the district level. Within the 'social-development' factors, the surfaced road length and electricity turned out to be the crucial indicators.

Ghose and De (1998) found positive and significant relationship between level of physical infrastructure and per capita net state domestic product between 1971-72 and 1994-95.

Ahmed (1996) put it "the most profound effect of infrastructure development could be on the attitude and values of rural households. Development of transport and communication infrastructure enhances the mobility of people and information through reduction in cost and time. The resulting increase in interaction contributes to changes in attitude and human capital development. The effects of these attitudinal changes are reflected in the increasing adoption of family planning practices, diminishing faith in superstition, increasing preference for processed/ value added products and also on various consumer goods produced outside."

Majumdar (2002), on the basis of regression analysis of the State level cross-section data for each of the years from 1971 to 1995 indicated that among various physical infrastructures, it was the 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.

Singh (1983) "found positive correlation between infrastructure and agricultural development. Among the various infrastructural facilities, agricultural development was strongly correlated with agricultural infrastructure index, followed by index of transport and communication.

Thorat and Sirohi (2002) attempted to analyse the impact of infrastructure on agricultural development using larger data set, both in terms of time period (pooling the data for four time periods, viz., 1961, 1971, 1981 and 1991) and coverage of infrastructural variables to include ten explanatory variables, viz., transport, power, irrigation, tractorization, research, extension, access to primary agricultural credit societies, regulated and wholesale marketing infrastructure, access to fertilizer sale points and commercial banks, covering physical, financial and research infrastructure. The results indicated that transport, power, irrigation and research infrastructure are four critical components, which affect the agricultural productivity in a significant manner. However, between transport and power, the former emerged as a more dominant variable. There was complementarity between the transport and power in the sense that the accessibility to roads is normally followed by accessibility to power. With improvement in access to power, the irrigation infrastructure also improved particularly through energization of pumpsets. In turn, improved irrigation facilities coupled with research input enhanced agricultural productivity. The other infrastructural facilities like access to fertilizer sale

points, markets, credit infrastructure, extension services, etc. also developed with development of transport infrastructure.

Ahmed and Hossain (1990). have provided the evidence linking poverty alleviation with infrastructure development. Infrastructure leads to increase in crop income among small farmers. **Bonney (1964)** observed that there was a direct relationship between increase in acreage of export crop cultivation and the standard of road and distance from main commercial centers. There is enhanced entrepreneurial activity; sharp decline in freight and passenger charges and improved service as a result of investments on rural roads. While analyzing the socio-economic impact of a new road on a small and isolated village community in Mexico.

World Bank study [1997] estimated that 15% of the agricultural 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. Poor rural road infrastructure 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. Easier access to market allows expansion of perishable and transport-cost intensive products.

International Fund for Agricultural Development [1995] observed that construction of rural roads almost inevitably leads to increase in agricultural production and productivity by bringing in new land into cultivation, intensifying existing land use to take advantage of expanded market opportunities. Better roads also lowered the transaction costs of credit services, resulting in increased lending to farmers, higher demand for agricultural inputs and higher crop yields.

According to Wharton [1967] agricultural infrastructures are categorized into [i] capital intensive, like irrigation, roads, bridges [ii] capital extensive, like extension services and [iii] institutional infrastructure, like formal and informal institutions. Infrastructure, such as irrigation, watershed development, rural electrification, roads, markets, in close coordination with institutional infrastructure, such as credit institutions, agricultural research and extension, rural literacy determines the nature and the magnitude of agricultural output in India. Adequate infrastructure raises farm productivity and lowers farming costs and its fast expansion accelerates agricultural as well as economic growth rate. It is acknowledged that infrastructure plays a strategic role in producing larger multiplier effects in the economy with agricultural growth.

Objectives

Main objectives of the study are;

1. To study the Role of Infrastructure in Agriculture and Rural Development
2. To study the role of Rural road development programmes on agriculture development

III. METHODOLOGY

Research Design – On the basis of fundamental Objectives of research our study is a type of Descriptive Research: - Descriptive research also known as statistical research Method of data collection – Secondary Data:- Large amount of secondary data is available in the forms of articles, manuals and previously conducted researchers on the similar topic. Also the data the gathered will help in identifying key parameters to examine through further exploration and thus will help in defining the Objectives.

Role of Infrastructure in Agriculture and Rural Development

Importance of infrastructure in agriculture and rural development are well documented. It is estimated that 15 percent of crop produce is lost between the farm gate and the consumer in the world because of poor roads and inappropriate storage facilities alone, adversely influencing income of farmers (World Bank 1997) Strengthening rural infrastructure can lead to lower production costs which can further augment agricultural output and income for rural farming community.

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 1994). Easier access to markets allows an expansion of the production 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 commercialization in agriculture and rural sector (Jaffee and Morton 1995)". There is increased scale of trade too and helps in reduction of trading costs per unit owing to economics of scale.

Further, dominance of poor is more in rural areas compared to urban areas. Therefore, any investment that helps to increase rural production, income and employment is expected to reduce poverty. Improvement in rural roads affect agricultural development followed development of social services. It is observed that roads tend to have a greater initial impact on 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). Therefore, more

developed the existing agricultural system, the more significant and the faster is the response to road provision or road improvements within an area. Access to better health and education usually improves more rapidly along roads than elsewhere.

The most significant justification of the large scale public investments in rural roads is to help the largely agrarian rural economy in exploiting the income opportunities for the farmers. India's most ambitious rural roads programme, PMGSY is also primarily aimed at providing connectivity to the markets. Higher agricultural production, lower inputs and transportation costs, improved cropping patterns and increased output prices are expected once farmers are connected through an improved all-weather road to the markets. These shifts have been clearly reflected and were attributed to the improved connectivity in some of the previous studies also. This study primarily aimed at assessing the sustainability of these impacts has also brought out that some shifts from traditional cultivations and marketing practices, if not sustained due to road degradation, can cause much larger negative impacts. It was found that changes in cropping patterns and withdrawal of traditional marketing intermediaries due to better connectivity can also cause huge losses if the new facilities by improved connectivity cease to exist, even temporarily.

As indicated earlier, the development of roads affects agriculture directly by enlarging the areas under cultivation. There is a two-fold relation between road development and increased agricultural products. Easy transport of manures, good seeds and better agricultural equipment, pesticides is made possible in time due to easy road transport. Better roads neutralise locational disadvantages in farming. Road development also prompts a change in the pattern of agricultural production by diversion of cultivation from food crops to commercial crops. Paucity of good roads in rural areas compels the cultivator to dispose of his produce to the village money lender at cheap prices. Good roads would open up the urban markets to the cultivator which would facilitate marketing of his product at higher prices. Moreover, bad roads are responsible for higher cost by transportation which increases the cost of marketing.

A good road system also aids agriculture indirectly by breaking up the isolation of villages, spreading education and creating a general sense of awakening. The rural industries like dairy farming, bee-keeping, poultry farming, and sericulture. etc., can be developed as subsidiary industries to supplement their income in their spare time.

Development of small scale and cottage industries becomes possible in rural areas due to the close road contact with their urban markets and the availability of raw materials at cheap prices. The important role played by the roads is very much felt during the days of famines. It has been observed regarding some of the Indian famines that the food scarcity in an area was not due to total deficiency. But owing to the isolation from the surplus area. Further, road development would facilitate flow of food from surplus to deficit areas and also equalize the prices in different markets. For relieving unemployment and promoting economic activity, road construction is an important item of the State governments to be taken up 56 to 70 per cent of the road cost of the road construction is spent as wages.

The economic impact of road on overall and agricultural development has been well documented in the studies surveyed in previous studies.

- **Increase in Cropping Intensity:** improved roads was increase in the cropping intensity (CI) to some extent via increase in mechanization and introduction of short duration cash crops.
- **Changes in Cropping Pattern:** With an improving the road infrastructure which leads to change in cropping pattern towards cash crops. The cash crops were taken as those crops which are mainly produced for sale in an area. The change in cropping pattern was due to improvement in transport facility for the sugarcane and vegetables. The convenience in selling milk after the road induced more acreage under fodder. And also it increases the gross cropped area due to availability of tractors in the village and even from outside.
- **Increase in Yield:** This has increased the use of fertilizers and seeds, resulting in mild increase in yield because of road infrastructure. and it will increase in yield for food and vegetable crops.
- **Saving of Wastage in Marketing:** The road has been reduce the wastage in marketing due to reduction in distance and time in transport of the agricultural produce especially in perishable crops like vegetables.
- **Impact on Vehicle operating cost Direct Benefits:** The immediate benefit of a road infrastructure would be savings in vehicle operating costs and employment generation to rural poor from construction of the road.
- **Introduction of New Activities:** Roads open opportunities for new activities allied to agriculture and in nonfarm sector and access to wage employment in other areas. The activities may include more dairy farming due to linkage with outside consumers, purchase tractors, passenger and transport vehicles by the villagers, opening of tea /general shops on road side, wage/trade opportunities outside the village.

Rural Roads Infrastructure development programmes in India

The necessity of a proper road network for the socioeconomic development of rural India and consequently the whole country was understood quite early in India. The first road development plan of 1943-61, popularly known as Nagpur Plan, looked at the road needs of the country on a long-term basis, and for the first time classified the road system into a functional hierarchy comprising National Highways (NH), State Highways (SH), Major district roads (MDR), Other District roads (ODR) and Village roads (VR). The last two classes of roads form the rural road system in the country. The third road development plan known as Lucknow Plan (1981-2001), estimated rural road requirement for the country and had spelt out various measures to develop rural roads. This plan suggested several approaches for rural road development. These approaches include preparation of long-term master plan for rural roads; stage construction in view of the low level of traffic in the initial stage of development of a rural road; integration of rural road development plan with the other rural development programs.

During all the road development plans the rural roads have received significant attention and emphasis. A number of programs were launched under several employment generation and poverty alleviation programmes of the Central and State Governments to achieve the goal of rural connectivity such as the Minimum Needs Program (MNP), National Rural Employment Program (NREP), Rural Landless Employment Guarantee Programme (RLEGP), Jawahar Rozgar Yojana (JRY) etc.; but these programmes failed to achieve their desired goals. A pragmatic analysis of the past schemes reveals many deficiencies in the whole process from planning to implementation and monitoring to evaluation. There was largely a misconception that rural roads being the lowest category of roads need no elaborate design and engineering. The Ninth Five Year Plan acknowledges that several thousand kilometers of such roads were constructed in the past without proper design and engineering and hardly commensurate with the resources that were allocated to the effort. As a result, rural roads had poor geometrics, inadequate compaction of embankment and inadequate drainage, so the roads that were built were hardly all-weather roads. Consequently, these roads did not last long.

Pradhan Mantri Gram Sadak Yojana (PMGSY)

In order to create durable and permanent assets, an adequate provision for drainage and protection works as well as quality control during construction and maintenance of assets, Government of India launched the Pradhan Mantri Gram Sadak Yojana (PMGSY) on 25th December, 2000 as a Centrally Sponsored Scheme to assist the States. The primary objective of PMGSY is to provide connectivity by way of an All-Weather road (with necessary culverts and cross-drainage structures, which is operable throughout the year), to the eligible unconnected habitations as per Core Network with a population of 500 persons (as per 2001 Census) and above in plain areas.

Sl. No.	Name the State	New Connectivity		Upgradation	
		Target (Total Length to be covered under PMGSY)	Achievement (upto March 11)	Target (Upgradation under PMGSY (60% of Upgradation Length))	Achievement (Upto March 11)
1	Andhra Pradesh	3326	3373.95	10321	15801.62
2	Arunachal Pradesh	6095	2924.27	2512	1.67
3	Assam	14571	10091.06	7828	16.20
4	Bihar	33544	7957.99	11149	4278.36
5	Chhattisgarh	37556	15895.04	10135	2513.48
6	Goa	40	1.87	114	156.83
7	Gujarat	7453	3938.42	5449	3217.98
8	Haryana	26	2.00	4515	4294.08
9	Himachal Pradesh	12832	7141.30	5659	2123.07
10	Jammu & Kashmir	8412	1744.24	3522	139.91
11	Jharkhand	21445	5589.70	7457	572.55
12	Karnataka	500	500.78	10153	13181.37
13	Kerala	439	592.98	2631	680.82
14	Madhya Pradesh	60264	33845.59	22342	12672.60
15	Maharashtra	4654	3055.83	11834	15699.60
16	Manipur	2131	2116.00	1428	472.94
17	Meghalaya	2662	949.76	2208	15.00
18	Mizoram	2021	1898.68	886	73.50
19	Nagaland	1789	1782.27	1023	857.71
20	Orissa	29374	15173.07	16996	4740.52
21	Punjab	979	820.13	6088	3542.47
22	Rajasthan	36472	33516.98	15670	14649.60
23	Sikkim	1107	955.11	508	1371.37
24	Tamil Nadu	4978	3348.55	13321	5747.11
25	Tripura	2980	1728.74	1406	256.76
26	Uttar Pradesh	38600	18904.88	34244	20409.38

27	Uttaranchal	10429	3108.00	4134	304.01
28	West Bengal	22995	10007.06	11375	683.69
	Total	367673	190964.24	224906	128474.20

Source: Annual Report 2013-14, Ministry of Rural Development, Government of India

Bharat Nirman

Bharat Nirman, one of the important Programmes launched by the Government of India in December 2005 identified six core infrastructure sectors in rural areas viz. rural housing, irrigation, drinking water, rural roads, rural electrification and rural telephone connectivity. Initially, it was launched as a time bound programme of construction of rural infrastructure for implementation during the four year period 2005-09. Rural Road, one of the six components of the program with a goal to provide with an all-weather road connectivity to all eligible unconnected habitations with a population of 1,000 persons and above (as per 2001 census) in plain areas and 500 persons and above in the case of Hilly or Tribal (Schedule V) areas. The Bharat Nirman Programme envisages a massive scaling up in terms of habitation connectivity coverage, construction targets, and financial investment. Up to March, 2014 a total of 51,253 habitations have been connected out of 63,940 habitations to be connected and works for connecting 62,876 habitations have been sanctioned. The targets and achievements of rural road network under Bharat Nirman are given in Table 4.

Table 4. Year wise target and achievement of rural road network under Bharath Nirman

Year	Target		Achievement	
	No of Habitations to be connected	Length of road work to be completed (in K.M)	No of Habitations connected	Length of road work completed (in K.M)
2005-06	7895	17454	8202	22891
2006-07	9435	27250	10801	30710
2007-08	12100	39500	11336	41231
2008-09	18100	64440	14475	52405
2009-10	13000	55000	7877	60117
2010-11	4000	34090	7584	45109
2011-12	4000	30566	6537	30995
2012-13	4000	30000	6864	24161
2013-14	3500	27000	6560	25316

Source: Annual report 2013-14, Ministry of rural development

Financing the Rural Road Infrastructure

Rural roads often receive the least attention in the network. This is because they are funded from a number of sources, at national regional and local levels. Similarly, they are managed with inputs from central, regional and local governments, and are situated at the intersection of transport, agriculture and local government mandates. They are treated sometimes as economic, sometimes as social investments. The Constitution of India limiting the Government's availment of adequate resources for financing rural infrastructure. The competing demands on budgetary resources and the limitations on borrowing from the market reduce the capability of State Governments to adequately fund rural infrastructure. More over the capacity of the government machinery to execute and deliver infrastructure projects in rural areas is limited in many States. It is thus clear that public sector resources will continue to fall short of the required infrastructure investments in the rural areas. Therefore, there is a need to look at private sector investments to supplement governmental resources. In order to encourage the private sector to join hands with the State machinery to provide and maintain infrastructure in rural areas, innovative funding methods including the PPP mode, annuity payments, viability gap funding, etc., need to be developed and implemented.

Rural Infrastructure Development Fund (RIDF)

Conventionally, public investment is considered as the major provider of rural infrastructure. It has enabling and encouraging effect on the private investment in agriculture. Lack of public investment in infrastructure influences the viability and effectiveness of private investment in a negative manner. However, it has not been possible to step up public investment in a big way. To address this concern, Government of India, instituted Rural Infrastructure Development Fund (RIDF) in 1995 in NABARD, entrusting it with the responsibility of channelising financial resources to the State Governments for rural infrastructure development. Since inception of RIDF, around 5.37 lakh projects involving an amount of Rs. 1,84,107 crore were sanctioned under various tranches. Out of the cumulative RIDF loans sanctioned as on 31 March 2014, agriculture and related sectors accounted for 43 percent (including 29 percent for irrigation), rural roads 31 percent and bridges 12 percent. The balance 14 percent of the loans was sanctioned under social sector projects. The sector-wise position is presented in Table 5. The RIDF investments have resulted in multitude of benefits including, creation of additional irrigation potential of 218.4 lakh, provision of rural connectivity through 3.8 lakh km. rural road network and 8.8 lakh meters long rural bridges.

Sector wise projects and amounts Sanctioned under RIDF I to XIX (as on march 2014)

Sector	No of Projects	Share in total (%)	Amount sanctioned (rs in crore)	Share in total (%)
Rural road	103046	19	57606.92	31
Social sector	100372	19	26134.57	14
Irrigation	273475	51	53613.57	29
Rural Bridge	17446	3	22268.95	12
Agricultural related	42442	8	24482.87	14
Total	536781	100	184106.54	100

Source: NABARD Annual Report-2013-14

IV. CONCLUSION

Rural roads are the wealth of a nation, a tool for social inclusion, economic development and environmental sustainability. Rural roads link communities and their agricultural fields to the main transport system and markets. Improving rural roads reduces transport cost and stimulates marketing. This results in increased production and productivity, crop diversification and increased profitability. A main bottleneck for local economic development is often a limited and poor quality rural road network. It is quite evident from the Plan documents that, private sector participation in road sector has been confined to development, maintenance and operation of specified highways (national and state), expressways, bridges and bypasses. Rural roads, particularly, those needed to link remote, hilly and backward settlements are hardly profitable to the private operator. Hence, without doing any major policy revamp on the development of rural road infrastructure, it is very difficult to expect private sector participation in this area and till that time Public investment must have to come in a big way and without any further delay. This crucial component of rural infrastructure, neglected during the reforms decade, need to be state financed in a time bound manner to prevent the rise in urban rural disparities in growth and development.

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