



## Impact of Rural Development on Economic Growth

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**Abstract:** This paper empirically investigates the relationship between rural infrastructure and agricultural productivity in the state of Rajasthan. The analysis has been carried out among the districts of Rajasthan for the period of 2010-2018. The paper presents a framework of availability and utilisation of rural infrastructure to analyse these linkages. By and large, existing literature has stressed the importance of making adequate infrastructure available. However, the utilisation of these infrastructures has not been considered for explaining the differences in productivity. Rural infrastructure development indices have been constructed by using principal component analysis for availability and utilisation indicators. Random effects model is applied to examine how different categories of infrastructure affect agricultural productivity. The study establishes that the role of availability of infrastructures in rural areas is contributing to agricultural productivity. Infrastructure utilisation index also turns out to be a positive determinant of agricultural productivity. Along with provision of infrastructures, fertiliser input continues to play an important role in agricultural development. Despite the fact that availability of data limited the variables that could be considered, the study throws up evidence in support of greater investment in infrastructures in rural areas while at the same time stressing the need to take steps to maximise the utilisation of existing resources. Therefore, it is important to invest in providing region specific infrastructures to resolve the disparities across region.

**Keywords:** Infrastructure, Productivity, Agriculture, Rajasthan

**Introduction:** The importance of infrastructure for development of agriculture has been widely recognised in most developing economies. Development of infrastructure is crucial especially in rural areas as they have implications for productivity gains and reduction in poverty (Fan and Thorat, 1999; Hazell and Haddad, 2001). Though climatic conditions, government support mechanisms, technological improvements, policy decisions, international trade etc, can facilitate better productivity; it does not diminish the importance of provision of adequate and appropriate infrastructural facilities at the ground level. The need to achieve balanced regional development has been one of the key challenges for India's policy planners for quite some time. Imbalances in developmental processes could also be due to the fact that only a few growing sectors dominate the progress of the economy, adding to the continuum of rural-urban differences. In this regard, agricultural sector which assumes primary importance in rural areas, has been performing relatively poorer compared to the other sectors. Its declining contribution to GDP share, despite more than half of rural population being involved in this sector, is a testimony to the relatively poor performance. Agricultural development as a strategy to minimise regional differences continues to assume prominence even today. The state of Rajasthan presents a good case to examine the relationship between agricultural development and rural infrastructure as its production performance has been quite varying (Chand et al, 2009; Kannan and Shah, 2010). With large dry areas and some districts drought-prone, the development of the regions has been lopsided with most of the Northern parts of Rajasthan at lower levels of development. “The vast extent of dry, unirrigated land, located primarily in Northern Rajasthan, casts its long shadow on the socio-economic development of the local people in many significant ways” (Planning Commission, 2006, p. 5). The differences in agricultural performance and existence of regional disparities are often attributed to variations in natural resources endowments and socio-economic and institutional factors (Deshpande, 2006). Northern districts of Rajasthan are poorer than the rest of the state (Planning Commission, 2007). Given the importance of infrastructure as a strategy for agricultural development, it is imperative to examine the pathways in which targeted infrastructure can help mitigate the regional disparities. Also, the scarce resources need to be mobilised to get the expected output and augment development of this primary sector. The present study examines the linkages between rural infrastructure and agricultural productivity across the districts of Rajasthan. The study attempts to analyse how different categories of rural infrastructure affected agricultural productivity over three decades across districts in Rajasthan. Along with infrastructures, other inputs and variables which are drivers of agricultural development have also been analysed in the paper. The paper has been organised into six sections. After a brief introduction, the paper focuses on reviewing the existing literature on the relationship between infrastructure and agricultural productivity in international and Indian contexts. This section also includes a discussion of the identified research gaps. The third section presents the conceptual framework and the classification of rural infrastructure adopted in the present paper. The data sources and methodology

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are presented in the fourth section, followed by the results of empirical estimation. The last section of the paper presents the conclusions of the analysis.

**Conceptual Framework:** The present study considers rural infrastructure to include economic infrastructure (irrigation, electricity, transport, telecommunication); institutional infrastructure (market, credit); and social infrastructure (education and health). These infrastructures contribute to agricultural development, either directly or indirectly. Agricultural development is a multi-dimensional phenomenon where different factors and conditions should work together to achieve the potential level of output. It is influenced by various factors such as agro-climatic conditions, development of rural infrastructure, technological improvements and economic policies.

The provision of both economic and institutional infrastructure, while making basic services and facilities available to the farming population, assumes that the producers have the required skills and competencies to tap their full potential. In this regard, the development of social infrastructure becomes important as it contributes to the development processes indirectly. Upgrading the skill formation of the farmers to achieve greater operational precision in accessing and utilisation of services by other infrastructural facilities is significant (Acharya et al, 1992). Such social infrastructure has not received as much attention in agricultural research literature as much as the economic and institutional infrastructure. When all three types of rural infrastructures are combined together with better agricultural input such as improved seeds, fertiliser and agricultural machinery, they contribute to decisions on inputs and farming practises thereby increasing agricultural production. Further, the infrastructures should be made available in rural areas. At the same time, it is proposed that, these facilities and services of the public need to be utilised to their fullest potential to benefit from these investments and reach greater levels of agricultural productivity. In our framework, economic policy and political factors are seen as exogenous factors that are required to invest in infrastructure.

**Selection of Developmental Indicators:** The three types of infrastructure being considered in the study are economic, institutional and social infrastructures. Each infrastructure category is normalised by geographical area if it pertains to a facility serving to an area or by rural population, if it is a service to the rural population. Overall rural infrastructure index has been constructed using availability and utilisation indicators of irrigation, electricity, transport, telecommunication, market, cooperative credit, education and health in rural areas. In this section, we briefly describe the variables used in the paper to capture the developmental indicators of agricultural and rural infrastructural development indicators. To indicate irrigation infrastructure, we have used the ratio of net irrigated area to net sown area to indicate availability of irrigation infrastructure and its utilisation by the ratio of gross irrigated area to total gross cropped area. Number of towns and villages electrified per thousand hectares of geographical area and irrigation pump sets per lakh hectare of net sown area are used to indicate electricity infrastructure. The paper considers only road transport to capture the transport infrastructure since road is the major avenue of connectivity in rural areas. We use total road length (km) per thousand hectare of geographical area to indicate the spread of road network. The motor vehicles (in thousand) per lakh rural population are taken as proxy for utilisation of road transport. Number of telephone exchanges per lakh hectare of geographical area and number of telephones (in '000) per lakh rural population were used as availability and utilisation indicators of telecommunication infrastructure. Institutional infrastructure index has been constructed using indicators of market and agricultural co-operatives. Regulated markets include those markets which are set up and maintained by the government. The availability of financial institutions is captured using number of agricultural credit co-operatives societies per lakh hectare of geographical area. Credit from agricultural co-operatives is used to capture the utilisation of these institutions. To construct the social infrastructure index, we used the availability indicators such as number of government primary schools per thousand hectare of geographical area and the number of primary health care centres per lakh hectare of geographical area for education and health infrastructure respectively.

**Model Specification:** In order to establish the linkages between rural infrastructure and agricultural productivity, we have estimated different kinds of equations. Since we have a panel dataset consisting of 19 cross-sectional units over 30 years, using a pooled OLS estimation would not be appropriate (Kennedy, 2003). To overcome these short comings, panel data techniques are more appropriate than single equation models. The OLS model neglects heterogeneity effects that are explicitly taken into the fixed effects model (Gujarati, 2011, p. 284). An econometric estimation using cross sectional and time series using OLS regression presents challenges such as controlling for endogeneity, possible omitted variables (unobserved fixed effects), and measurement errors in estimation (Dorosh et al, 2010, p-6). The present paper uses the random effects model for estimation of the relationship between rural infrastructure and agricultural



development in Rajasthan. The random effects estimation has a generalised covariance matrix to include the distribution of residuals. Random effects model includes individual error components which are not correlated with each other. Unlike the fixed effects model, in random effects model the individual intercept is uncorrelated with the regressors. The coefficient estimates in the model are the outcome of a weighted average of time series and cross sectional relationship between the variables. The Wald-Chi square test shows the overall statistical significance of the model.

**Determinants of Agricultural land productivity using infrastructure indices:** For the present analysis, the paper uses agricultural land productivity as the dependent variable measured by agricultural net state district domestic income Rs per hectare of net sown area. The explanatory variables in the model include indices of overall availability and utilisation of rural infrastructure, fertiliser consumption, tractors and tillers, area under HYV, and rainfall variability. We also introduce a regional dummy distinguishing the Southern and Northern districts of Rajasthan so as to capture the regional differences in land productivity.

**Determinants of land productivity using overall rural infrastructure index:** We regress overall rural infrastructure index which includes both availability and utilisation infrastructure indicators, and other variables such as fertiliser consumption, tractors and tillers, area under HYV, rainfall variability and regional dummy on land productivity. Presents the estimation results of land productivity with overall rural infrastructure index where the combined effect of availability and utilisation of infrastructures are being captured in the model. Panel regressions are appropriate than pooled linear regression as shown by the Breusch-Pagan statistic. The model has a good overall fit and the explanatory power of the model is around 33 per cent. The random effects model III shows that overall infrastructure has positive and highly significant impact on land productivity. A significant coefficient value of 0.41 for overall index of rural infrastructure implies that a 1% improvement in provisioning and utilisation of infrastructure facilities could induce increases in land productivity by almost 0.4%. The coefficient of fertiliser usage is positive and highly significant. The coefficient of regional dummy is positive and significant suggesting that districts lying in the Northern parts have relatively lower land productivity. Therefore, the results of the model show that improvement in provisions and usage of rural infrastructures along with increased use fertiliser use, adoption of mechanisation bring about increases in overall productivity in agriculture.

**Conclusion:** Considering the importance that agricultural sector holds for Rajasthan economy, the present paper assesses the relationship between agricultural productivity and infrastructure development across the districts of Rajasthan. The foregoing analysis provides insights into understanding the main drivers of agricultural productivity in Rajasthan using land productivity as the dependent variable. In order to examine the relationship between rural infrastructure and agricultural productivity, the paper focused on different classifications of rural infrastructure and estimated the influences of infrastructure on agricultural productivity using district level data for the period between 1980 and 2010 in Rajasthan. In contrast to the earlier studies, the present analysis develops infrastructure availability and utilisation indices to examine the impact of rural infrastructure on agricultural productivity. We employed a random effects model to estimate the relationship between rural infrastructure and agriculture using a panel of 19 cross-section units spanning over 30 years. The random effect estimations showed the importance of rural infrastructure in boosting agricultural productivity. The study emphasises the role of making the infrastructures available in rural areas as significantly 14 contributing to agricultural productivity. Infrastructure utilisation index has turned out to be significant and positive, indicating that utilisation of infrastructure can also influence productivity in agriculture positively. Also, more developed districts have better infrastructure facilities while the lagging regions are inadequate both in terms of infrastructure availability and utilisation. Along with infrastructures, the use of traditional inputs such as fertiliser application and the mechanisation of agriculture as indicated by tractor use are also responsible for significant differences in land productivity across the districts. There is a need to introduce new infrastructures and efficient use of existing ones in rural areas. Resolving regional disparities does not call for equalising provisions of every infrastructure, but provision of those that are region specific. Improvements in institutional mechanisms can go a long way in improving agricultural productivity. Utilisation infrastructure index of economic indicators turns out to be a positive determinant of agricultural productivity. Optimal utilisation of existing infrastructure is a result of a combination of factors. Utilisation of some infrastructure is conditional on the availability and quality of other infrastructure and it is possible that the lowest common denominator determines the overall utilisation of infrastructure. Thus, rural infrastructure affects agricultural productivity directly through improvements in infrastructures. Therefore, assessing the importance of utilisation of the



infrastructure brings to fore several key points that may be ignored if focus remains only on addition to the stock of infrastructure. Further, strengthening human capital and augmenting information awareness enables better usage of existing structures. Thus, the study throws up evidence in support of greater investment in infrastructures in rural areas while at the same time calling for steps to be taken to maximise the utilisation of existing resources.

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