IMPACT OF RURAL INFRASTRUCTURE ON AGRICULTURE PRODUCTIVITY - A CASE STUDY OF ANDHRA PRADESH

P. Ramalingeswara Rao
Research Scholar
Rayalaseema University, Kurnool
pandrangi_rao@yahoo.com

Dr. S.V. RAMANA
Principal & Professor
Hindu college of Management, Guntur

Abstract:

This paper examines the relationship between rural infrastructure and agricultural productivity in the state of Andhra Pradesh. An analysis has been done between the districts of Andhra Pradesh for the duration of 1990-2010. The paper presents a framework for the availability and utilization of rural infrastructure for analyzing agriculture productivity. Present and large, existing literature has emphasized the importance of providing adequate infrastructure. However, the use of these infrastructures is not considered to explain the difference in productivity. Development Index of Rural Infrastructure has been constructed using key component analysis for availability and usage indicators. Random effects models are applied to check that different categories of infrastructure affect agricultural productivity. Studies show that the role of availability of infrastructure in rural areas is contributing to agricultural productivity. The Infrastructure Utility Index has proven to be a positive determinant of agricultural productivity. With the provision of infrastructure, fertilizer input is playing an important role in agricultural development. Regardless of the fact that the variables that can be considered in the availability of data are limited, this study left evidence in support of more investment in infrastructure in rural areas while at the same time taking steps to maximize the use of existing resources. Therefore it is important to invest in providing region-specific infrastructure to solve inequalities across the region.

Introduction:

The importance of infrastructure for the development of agriculture has been widely recognized in most developing economies. The development of infrastructure is particularly important in rural areas because they have implications for productivity gain and poverty reduction (Fan and Thorat, 1999, Hazel and Haddad, 2001). Although climate conditions, government support mechanisms, technical improvements, policy decisions, international trade, etc. can provide better productivity; it does not reduce the importance of provision of adequate and suitable structural facilities at the grassroots level. The need to achieve balanced regional development is one of the important challenges for India's policy planners for some time now. An imbalance in developmental processes can also be due to the fact that in some growing areas, the economy is dominated by the progress, due to which rural-urban divisions are continued. In this regard, the agricultural sector, which takes primary importance in rural areas, is performing relatively poorly against other areas. Despite the decline in GDP share, despite more than half of the rural population involved in this area, there is evidence of relatively poor performance. As a strategy to reduce regional differences, agricultural development continues to follow prominence today.

Andhra Pradesh presents a good case for investigating the relationship between agricultural development and rural infrastructure because its production performance is quite different (Chand et al, 2009: Kannan and Shah, 2010). With the drought-prone in large dry areas and in some districts, development of areas has become one-sided with most Rayalaseema parts of Andhra Pradesh at the lower level of development. "In the existence of agricultural performance and regional inequalities, in the vast majority of dry, unincorporated land located mainly in Rayalaseema, it has its long shadow over many important ways of local people's socio-economic development" (Planning Commission, 2006, page 5) The difference is often due to variations in natural resources donations and socio-economic and institutional factors (Deshpande, 2006). The Rayalaseema region of Andhra Pradesh is poor compared to the rest of the state (Planning Commission, 2007). Given the importance of infrastructure in the form of a strategy for agricultural development, it is important to examine the routes in which the targeted infrastructure can help in reducing regional inequalities. In addition, rare resources should be mobilized to achieve the expected production and to increase the development of this primary area.The present study examines the relationship between rural infrastructure and agricultural productivity in all the districts of Andhra Pradesh. The study attempted to analyze agricultural productivity affected by rural infrastructure for two decades in various districts of Andhra Pradesh. Along with the infrastructure, other inputs and variables of the development of agriculture have also been analyzed.

This article has been organized in six volumes. After a brief introduction, the paper is focused on reviewing existing literature on relations between infrastructure and agricultural productivity in international and Indian contexts. This section includes discussion of the interval of research that has been identified, the third section presents conceptual framework and presents a classification of the rural infrastructure adopted in the current paper. The data source and methodology is presented in the fourth part, after which the result of empirical assessment. The last section of the paper presents the findings of the analysis.

Review of Literature

The relations between infrastructure and productivity have been examined by various researchers and policy makers. At the beginning of 1989, Asschor examined the productivity of the public capital in the United States, for which he brought government spending as a proxy to the public in production expenditure. Since the assessment of Aschauer did not include other determinants of production or the definite effects, the estimation is more likely to be influenced by counterfeit correlations. Some authors have identified relationships between public infrastructure and economic development to eliminate problems of timetable data, which have used the time series and cross-section data collected. Munnell (1990) used basic infrastructure such as highways, water and sewer systems and others, and examined each type of infrastructure.

Most of the economies, which are mainly in agricultural nature, have demanded a probe into how agricultural productivity can be increased through specific investment in infrastructure. Using agricultural level data, Segun (2008) examined the infrastructure in agriculture productivity in Nigeria and found that the index of rural infrastructure has had the highest positive impact on agricultural productivity. In a provincial level study, Li and Liu (2009) examined the development of basic infrastructure in agricultural production and established that except for telecommunications, all other infrastructure variables had a positive impact on agricultural production. Lavalty (2012) used the random effects GLS regression model and found that access to agricultural and paved roads had a positive and significant impact on agricultural labor productivity, whereas there was a positive but unimportant relationship with agricultural labor productivity in the field of irrigation.

Some studies used the methodology of factor analysis to reach the total index (Rao, 1990, Majumdar, 2004, Swaminathan, 2009) and examined agricultural development. For example, a study of Majumdar (2004), whose purpose is to test the relationship between the availability and development of infrastructure through various indices for a period of twenty years spread over 1971-1991 at the district level; It was found that cooperation of agricultural development was strong with strength after infrastructure (0.21), education (0.20) and transport infrastructure (0.17).In the Indian context, Ashok and adopted total factor productivity approach to the Tamil Nadu districts Balasubramanian (200 9) during 2003-04 from 1998-99 and found that irrigation is the largest positive impact of roads, markets and literacy. Ghosh and D (2004) examined the role of various infrastructure in determining the level of economic development in Indian States in their letters. Swaminathan (2009) adopted the method of Behal to arrive at an assessment of the infrastructure index and used the modified Cob-Doullas production work with the input of infrastructure in the form of input. The results show that the spread of social infrastructure was maximum (0.28), followed by economic (0.21) and general infrastructure (0.17), which highlighted the importance of social infrastructure in achieving inclusive growth / barrier in the economy ofMaharashtra.

Using the definitive impact model with the introduction of agroclimate and time interaction, Binswanger et al (1999) found that in addition to irrigation, the outlay for all other infrastructure affected the total crop production positively. Fan et al (1 999) used a simultaneous equation model and showed that the investment in increasing productivity and government spending on rural infrastructure directly in the village Training in reducing poverty and indirectly increase agricultural productivity.

After a brief outline of research studies, it is clear that most studies analyze the availability of infrastructure in investigating their relationship with agriculture. Studies examining the relationship between agricultural productivity and infrastructure have emphasized the importance of primarily infrastructure provision. It is in the current study that establishment of infrastructure in rural areas will not only affect the improvement in agricultural productivity. Use of these infrastructure reserves is essential for achieving the desired level of development. How can agricultural development be affected by the use of rural development to explain differences in productivity in existing literature? The main contribution of this letter is basically in evaluating the importance of the use of existing infrastructure to achieve desirable goals along with availability of infrastructure.

To go beyond macro analysis, analyze the relationship between infrastructure and agriculture. Regional characteristics, agro-climatic variability, government policies are so different that it is useful to understand the contribution of infrastructure for agricultural development in a specific context for an analysis at a sub-national level. In this regard, in the present study, efforts are made to test the impact of rural infrastructure on agricultural productivity at district level for two decades in the current study.

The current study tries to answer the following research questions:

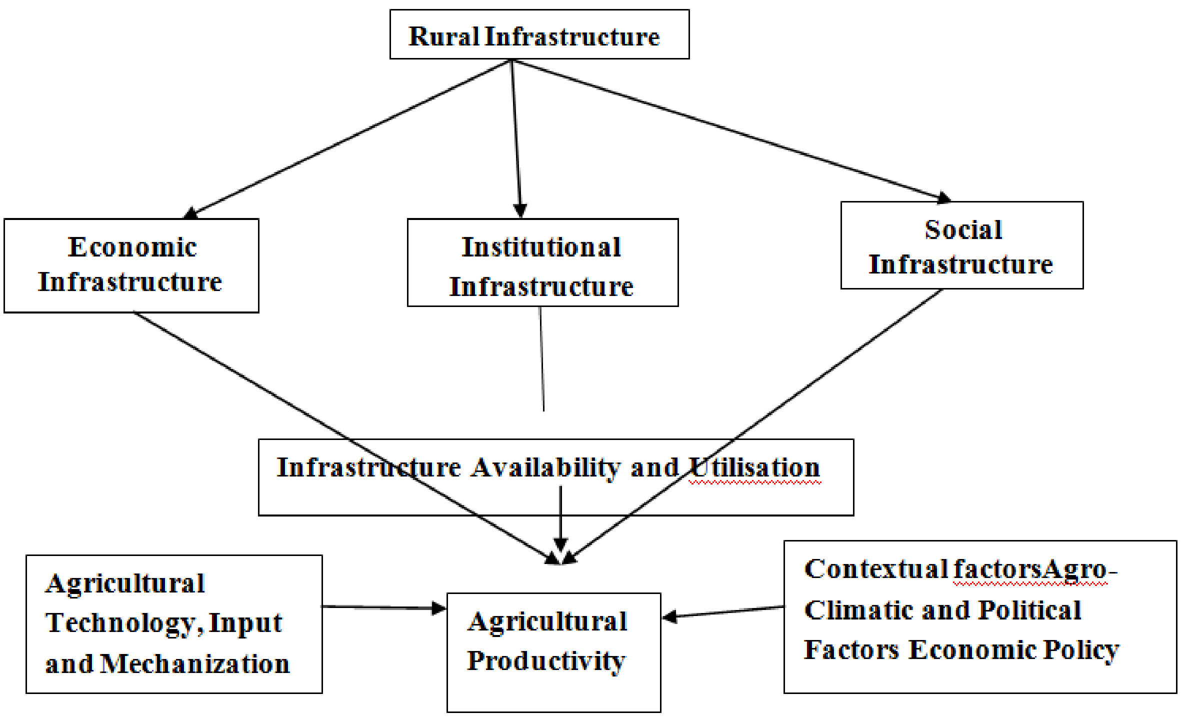
- Does agricultural productivity have a significant impact in rural infrastructure development?

- What type of rural infrastructure has the biggest impact on agricultural productivity?

Conceptual Framework

In the current study, rural infrastructure is considered to include economic infrastructure (irrigation, electricity, transport, telecommunications); Institutional infrastructure (market, credit); And social infrastructure (education and health). These infrastructure contribute to agricultural development, either directly or indirectly. Agricultural development is a multi-dimensional event, where various factors and conditions should work together to achieve the possible level of production. It is affected by various factors such as agro-climatic conditions, rural infrastructure development, technological improvements and economic policies, as shown in Figure 1

Agriculture and Rural Infrastructure



While creating the basic services and facilities available for farming population, the provision of both economic and institutional infrastructure assumes that the producers have the necessary skills and skills to tap their full potential. In this regard, the development of social infrastructure becomes important because it contributes to indirect development processes. It is important to upgrade the skill building of the farmers (Acharya et al, 1992) to achieve more operational accuracy in the use and utilization of services by other infrastructural facilities. Such social infrastructure has not been given much attention in agricultural research literature as much as economic and institutional infrastructure. When all three types of rural infrastructure are added to better agricultural inputs such as a better seed, fertilizer and agricultural machinery, they contribute to decision making on input and agricultural practices, thereby increasing agricultural production. Apart from this, infrastructure should be provided in rural areas. At the same time, it is proposed that the public of these facilities and services need to use their full potential to avail these investments and reach the maximum level of agricultural productivity. In our framework, economic policy and political factors are seen as excluded factors, which are necessary to invest in infrastructure.

Data and Methodology

1. Data Sources

To build indices for rural infrastructure, the study adopted the method of Principal Composite Analysis (PCA) in order to add development indicators in the overall index. PCA is a widely used method where it explains the variation of the variable observed on the basis of the set of dimensions. Several studies have used the PCA to the Development Index (Venkataraman et al, 1 9 85; Geythri, 1997, D and Ghosh, 2005 D, 2010).

The correlated original variables are transformed into a new set of uncorrelated variables using the correlation matrix. This statistical technique linearly transforms an original set of variables into a substantially smaller set of uncorrelated variables that explain most of the information in the original setof variables. The PCA technique takes N variables x1,x2 ,..xN and finds linear combinations of these to produce principal components Z1 ,Z2 ,...ZN that are uncorrelated. This can be presented in the following form:

$$\mathbf{Z_1=a_{11}x_1 + a_{12}\,x_2 + \ldots + a_{1N}x_N}$$
$$\mathbf{Z_1=a_{21}x_1 + a_{22}\,x_2 + \ldots + a_{2N}x_N}$$
$$\ldots\ldots$$
$$\ldots\ldots$$
$$\mathbf{Z_N=a_{N1}x_1 + a_{N2}\,x_2 + \ldots + a_{NN}x_N}$$

PCA uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of uncorrelated variables called principal components. There are N principal components i.e. the same as the number of variables. The Z1 or the first Principal Component is constructed as $Z_1 = a_{11}\,x_1 + a_{12}\,x_2 + \ldots\ a_{1N}x_N$.

PCA consists of finding the eigen values λj of the correlation matrix. The correlation coefficients between the principal components Z and the variables x are called component loadings, r (Z, x) j i. Finally, the factor loadings for the first Principal Component Z1 are obtained by dividing each column (or row) sum by the square root of the grand total. The factor loadings thus obtained are the correlation coefficients of the respective indicator with the composite index. The weights are applied to all the variables xj in Equation (1) to satisfy the conditions of being uncorrelated and that the first component accounts for the maximum possible proportion of the variance of the set of x s.

In order to rule out a single variable to have its influence on the factor loadings, the variables were standardised based on geographical area or population and then linearised to remove the scale effects (Nardo et al, 2005). The variables of infrastructure availability and utilisation used to construct the developmental indices are given in Table 1.

For estimating the relationship between rural infrastructure and agricultural productivity, we used a large panel set using random effects in which agricultural productivity is a function of infrastructure indices, human capital and natural resource factor. The data set is a balanced panel of 23 districts for the twenty -year period in the state of Andhra Pradesh.

3. Selection of Developmental Indicators

Studies have shown that three types of infrastructure are economic, institutional and social infrastructure. Every infrastructure category is normalized by the geographical area if it is related to the facility related to any area or rural population, if it is a service for the rural population. In rural areas, the overall rural infrastructure index has been created using irrigation, electricity, transport, telecommunications, market, cooperative loans, education and health indicators and utilization indicators.

In this section, we briefly describe the variables used in paper to capture development indicators of agricultural and rural infrastructure development indicators.

To indicate the irrigation infrastructure, we have used the proportion of pure irrigation sector in the net sown area for the availability of irrigation infrastructure and the ratio of gross cropped area to the ratio of total gross cropped area. The number of towns and villages electrified in the geographical area per thousand hectares and in the pure sowing area, irrigation pump set is used in every lakh hectare to indicate the electrical infrastructure.

Paper considers only road transport to achieve the transport infrastructure, because the road is the main road of connectivity in rural areas. To spread the road network, we use the total road length (km) for every thousand hectare geographical area. Motor vehicle (in thousand) per rural population is taken as a proxy for the use of road transport. The number of geographical areas per lakh hectare and the number of telephones (in 000) per rural population was used as indicators of availability and utilization of telecom infrastructure.

Institutional infrastructure has been constructed using indicators of market and agricultural cooperatives. Regulated markets include those markets which are set up and maintained by the government. The availability of financial institutions is utilized by using the number of agricultural credit co-operative societies in lakh hectares per geographical area. Loans are used by agricultural co-operative societies to capture the use of these institutions.

In order to create social infrastructure, we used the indicators available as a number of government primary schools in the geographical area per thousand hectare and for the education and health infrastructure, the number of geographical areas of every million hectares of primary health care centers The basis of the number was the base.

Table 1: List of Variables of Rural Infrastructural Development

No.	Infrastructure Types	Indicators	Variables	
			Availability	Utilization
		Irrigation	Ratio of Net Irrigated Area to Net Sown Area	Ratio of Gross Irrigated Area to Gross Cropped Area
		Electricity	No. of villages and hamlets electrified per thousand hectare of geographical area	Irrigation pump sets electrified (on '000) per lakh hectare of Net sown area

1.	Economic Infrastructure	Transport	Total road length (km) per thousand hectare of geographical area	No. of total registered motor vehicles (thousand) per lakh rural population
		Telecommunication	No. of telephone exchanges per thousand hectare of geographical area	No. of telephones in use (hundreds) per lakh rural population
2.	Social Infrastructure	Education	No. of primary schools per lakh hectare of geographical area	No. of students in primary schools per lakh child population in the age group of 5-14 years
		Health	No. of Primary Health Centers per lakh hectare of geographical area	No. of cases of immunization (in thousands) per lakh rural population
3.	Institutional Infrastructure	Markets	No. of regulated markets per lakh hectare of geographical area	Value of Turnover (Lakhs) per thousand hectare of NSA
		Agricultural Credit	No. of primary agricultural credit cooperatives per lakh hectare of geographical area	Loans from Agricultural Credit Co-operatives per lakh cultivators

In the field of pure seeding, it is taken as a dependent variable in NSDP (continuous price 1999-00) for hectare because it captures the income received by various factors of production. Assessing the econometric model, it is called land productivity in our paper. We use rain variability to catch the natural resource variables, which have a direct impact on agriculture. Fertilizer consumption per kilogram per kg (kg) per kg per kg, in the purified area, percentage of area under HIV (thousands) and total number of tractors in the total sowing area, including electricity tiller (in lakhs) per lakh hectare, Technology and mechanization variables, respectively.

4. Model Specification

In order to establish a relationship between rural infrastructure and agricultural productivity, we have estimated different types of equations. Since we have a panel dataset with more than 30 years of 19 cross-sectional units, using the OLS estimation of a pool will not be suitable (Kennedy, 2003) to overcome these small fears, the panel data technique is called Single Equation Model Are more suitable than.

The OLS model has ignored the diverse effects which have clearly moved to a definite impact model (Gujarati, 2011, page 284). Using the cross-sectional and time series, using the OLS regression, challenges for the interval of a quantitative estimation, possible omitted variables (unpublished fixed effects), and measurement errors (Dorosh et al, 2010, P-6) Presents.

The present paper uses the random effects model in Andhra Pradesh to estimate the relationship between rural infrastructure and agricultural development. A generalized covariance matrix for random effects estimation to include the distribution of residues. Random effects models include individual error components that are not correlated with each other. Unlike fixed effects models, random effects are incompatible which regresses with different interceptions in the model. The estimation of coefficient in the model is the result of the cross-sectional relationship between the weighted average and variable of the time series. The Wald-Square Square test shows the overall statistical significance of the model.

By using the random effects GLS regression model we estimate the relationship between infrastructure and agricultural productivity.

$\mathbf{y_{it} = \beta_i X_{it} + \alpha_i + w_{it}}$
Where,

$\mathbf{y_{it}}$ is the dependent variable where i = district and t = time
$\mathbf{X_{it}}$ represents independent variables
$\boldsymbol{\beta_i}$ is the coefficient of independent variables
$\mathbf{w_{it}}$ is the composite error term including $\mathbf{w_{it}= u_{it}+ \varepsilon_{it}}$ where $\mathbf{u_{it}}$is the cross section error component, and $\boldsymbol{\varepsilon_{it}}$is the combined series and cross section error component.

Empirical Estimation

Before presenting the empirical results of investigating the relationship between agricultural productivity and rural infrastructure, we present descriptive figures with the number of comments, mean and standard deviation. Table 2 summarizes the statistics of development indicators of the variables used in agriculture, infrastructure availability and usage. Apart from the HIV area (%) and rainfall variability which have been taken in their proportionate forms, other variables are in their logarithmic form in the analysis.

Table 2: Summary Statistics

Sl No	Variable	Definition	No. of Observations	Mean	StdDev
a.	**Dependent Variable**				
1.	Agricultural Land productivity	Agricultural NSDP (Constant Prices 1999-00) in Rs per hectare of net sown area	570	9.67	0.73
b.	**Independent variables**				
2.	Infrastructure Availability index	Index measure from PCA using all measures of infrastructure availability indicators	570	1.68	054
3.	Infrastructure Utilization index	Index measure from PCA using all measures of infrastructure utilisation indicators	570	1.37	0.57
4.	Overall Infrastructure index	Index measure from PCA using all measures of rural infrastructure indicators	570	1.71	0.43
5.	Input	Fertilizer consumption per lakh hectare of Net Sown Area	570	11.35	0.74
6.	Machinery	Number of tractors and tillers per lakh Net Sown Area	570	3.89	0.90
7.	Technology	Area under HYV as a percentage of Net Sown Area	570	37.02	16.57

8.	Rainfall Variability	Deviation in actual average rainfall (mms) from district specific normal rainfall (mms)	570	43.17	316.92

Note: Except rain variability and area under HIV, all other variables are in their logarithmic form. Source: Author compilation.

Stationary Test Results

Since the variables used in the analysis are of thirty years of age, we therefore test for stable because these time series variables can display the behavior of the trend. If those variables are not stable, then the concept of unimaginable property will not be good, therefore, to check the unit root properties of the variable, the paper uses the LM panel root test (Haydry, 2000). Strike LM Panel Unit-The null hypothesis of the root says that all panels are stable in nature. Its alternative hypothesis states that the unit can be root in some panels. In Table 3, the Hadri LM panel presents the test of the variable using the unit tests.

Table 3: Hadri LM Panel Unit Root Test

Variable	Z Statistic	p value	Order of Integration
Land Productivity	-0.94	0.826	I (0)
Infrastructure Availability Index	-1.60	0.946	I (0)
Infrastructure Utilisation Index	-1.63	0.949	I (0)
Overall Rural Infrastructure Index	-0.48	0.683	I (0)
Fertilizer consumption	-2.21	0.986	I (0)
HYV area %	-1.57	0.058	I (0)
Tractor use	-3.40	1.000	I (0)
Rainfall variability	-1.15	0.875	I (0)

Source: Author's Compilation

The results of the panel unit root test show that the variable levels are as stable. Variables like Infrastructure Availability Index, Composite Infrastructure Index, Fertilizer Consumption, Tractor Use and Rain Variability, are stable as level at 5% level of importance. The HVY area (%) is stable on the importance of 10 levels as its level. Therefore, we do not reject zero concept and conclude that all the variables exhibit stable assets in the form of their level. We then proceed to estimate the random impact model for establishing determinants of agricultural productivity in Andhra Pradesh.

Results of Empirical Estimation

Determinants of Agricultural land productivity using infrastructure indices

For the current analysis, agriculture uses agricultural land productivity, which is per hectare per hectare area as a dependent variable measured by the household income of agricultural net state district. The explanatory variables in the model include the rural infrastructure, fertilizer consumption, tractor and tiller, the overall availability and utilization of the area under the HYV and the rainfall variability. We also present a regional dummy distinguishing southern and northern district of Andhra Pradesh so that regional differences in land productivity can be achieved.

In Table 4, we present the results of estimation of relations between land productivity and infrastructure using the use of rural infrastructure facilities and utilization indicators. Infrastructure availability and infrastructure use index have a positive relationship of 0.94. Therefore, we have estimated two different models as shown in Table 4.

Table 4: Panel model of Land Productivity with Rural Infrastructure Indices

Variables	Pooled OLS	Random effects I	Pooled OLS	Random effects II
Infrastructure Availability index	0.24*** (4.41)	0.26*** (6.35)	----	----
Infrastructure Utilisation index	----	----	0.27*** (5.34)	0.35*** (9.38)
Fertilizer consumption	0.23*** (4.34)	0.16*** (4.08)	0.24*** (4.45)	0.16*** (4.25)
Tractor use	0.11* (2.88)	0.11* (3.18)	0.13 (3.29)	0.09** (0.005)
HYV Area (%)	0.00001 (0.01)	0.001 (1.23)	0.0002 (0.25)	0.001 (1.24)
Rainfall variability	-0.00002 (-0.58)	-0.00002 (-0.8)	-0.00002 (-0.60)	-0.00002 (-0.59)
Regional Dummy	0.16*** (6.06)	0.16*** (8.81)	0.17*** (6.91)	0.18*** (10.31)
Constant	2.58*** (11.88)	2.90*** (16.94)	2.54*** (11.76)	2.89*** (17.58)
No. of observations	570	570	570	570
R square Within Between Overall	0.38	 0.52 0.17 0.38	0.38	 0.52 0.12 0.38
Breusch-Pagan LM test, chi2 (p-value)	1383.12 (0.000)		1525.84 (0.000)	
F value	F(6, 563)= 56.7 Prob>F=0.00	Wald chi2(6)=591.5 Prob> chi2=0.00	F(6, 563)=59.1 Prob>F=0.00	Wald chi2(6)=683.1 Prob>Chi2=0.00

Note: Figures in parentheses indicate t value,
***Significant at 1%, ** Significant at 5 %, * Significant at 10%

Source: Author's Calculation

Regression result of random effects shows the positive and significant relationship of farm land productivity with the availability of model 1 rural infrastructure (0.16 ***). The growth of 1 unit in infrastructure provisions in rural areas is associated with an increase of about 0.24 units in land productivity. Estimated coefficient value for fertilizer usage is extremely important and positive cooperation with land productivity. The tractor representing the machinery is positive and important, which is at 10 percent. HIV area (%), which is used as a proxy to capture technology, shows a positive sign, though not significant

The coefficient of regional dummy variable is positive and critical at 1% level, suggesting that the productivity of the land is relatively high in the southern districts because it is relatively high compared to the Rayalaseema region. This model is fit according to the Wald Chi

Square price of 591.5. The Breusch-Pagan data clearly establishes that the panel regression pools are better suited for linear regression. The model provides a good interpretive framework, which explains about 38 percent variants in the dependent variable.

Similarly, according to random effects model II, regression production, where the use of infrastructure index has been used as an explanatory variable, shows high and significant relationships with land productivity. It is important to note here that the coefficient of utilization index is more than the availability index for determining improvement in land productivity, indicating that with the provision of infrastructure, together with the existing infrastructure to take full advantage of its benefits Full capacity of Fertilizer input has been an important indicator of agricultural productivity. Increase in fertilizer input usage by 1% increases productivity of land by 24%. Variations in the occupied rain due to variation of rainfall are negative although there are significant links with land productivity. Increasing use of tractors and tillers in promoting mechanization in agriculture has shown positive relations with land productivity. The overall R2 of 38 percent shows that the interpretive power of the model is good.

Determinants of land productivity using overall rural infrastructure index

We return to the overall rural infrastructure index, which includes indicators of both infrastructure and fertilizer consumption, tractor and tiller, area under Himachal Pradesh, rain variability on land productivity, and other variables such as regional dummy, both availability and utilization.

Table 5 presents the estimated results of land productivity with the overall rural infrastructure index, where the model is being taken jointly with the availability and utilization of the infrastructure. The panel regression pool is appropriate from linear regression as shown by BrucePagan Assessment. The model has a good overall fit and the clarification power of the model is about 33 percent.

Random Effects Model III states that the overall infrastructure has a positive and highly significant effect on land productivity. The critical coefficient of 0.41 for the overall index of rural infrastructure is to assume that 1% improvement in the provision and utilization of infrastructure facilities can induce an increase of about 0.4% in land productivity. The coefficient of fertilizer use is positive and very important, the coefficient of regional dummy is positive and it is remarkable that the district lying in the northern parts has relatively less land productivity, hence the results of the model show that the improvements in the provisions of rural infrastructure and utilization of fertilizer fertilizer Along with adoption of mechanization, the increase in overall productivity in agriculture is increasing.

Table 5: Panel Model of Land Productivity with Overall Rural Infrastructure Index

Variables	Pooled OLS III	Random effects III
Overall Index	0.36*** (5.40)	0.41*** (8.72)
Fertilizer consumption	0.23*** (4.24)	0.16*** (3.99)
Tractor use	0.10 (2.44)	0.07** (2.10)

HYV Area (%)	0.001 (0.45)	0.001** (0.02)
Rainfall variability	-0.00002 (-0.44)	-0.00001 (-0.46)
Region Dummy	0.16*** (6.20)	0.16*** (9.09)
Constant	2.54*** (11.74)	2.86*** (17.20)
No of observations	570	570
R square		

Within Between Overall	0.39	0.55 0.15 0.38
Breusch and Pagan LM test, chi2 (p-value)		1480.61 (0.000)
F value	F (6, 563) = 59.18 Prob> F = 0.000	Wald chi2(6)=658.6 Prob> F = 0.000

Note: Figures in parentheses indicate t value,
***Significant at 1%, ** Significant at 5 %, *Significant at 10%
Source: Author's Calculation

Conclusions

The importance of agriculture sector for Andhra Pradesh's economy is, the current paper evaluates the relationship between agricultural productivity and infrastructure development in all the districts of Andhra Pradesh. The foregoing analysis provides insight into understanding the main drivers of agricultural productivity in the dependent state as dependent variables on the basis of land productivity. For checking the relationship between rural infrastructure and agricultural productivity, paper focused on different classifications of rural infrastructure and on agricultural productivity using district level data for the period between 1990 to 2010 in Andhra Pradesh.

Contrary to earlier studies, the current analysis develops the Basic Availability and Usage Index for the investigation of the impact of rural infrastructure on agricultural productivity. We have developed a random impact model to estimate the relationship between rural infrastructure and agriculture by using a panel of 23 cross-section units spread over 20 years. Random effects estimates reflect the importance of rural infrastructure in increasing agricultural productivity; Studies emphasize the role of providing infrastructure in rural areas as there is a significant contribution in agricultural productivity. The infrastructure use index has proved to be important and positive, indicating that the use of infrastructure can affect productivity in a positive way in agriculture. Apart from this, there are better infrastructure facilities in more developed districts, whereas in the case of availability and utilization of infrastructure, both backward areas are inadequate. As well as structural structures, the use of traditional inputs such as fertilizer application and mechanization of agriculture, as shown by the use of tractor, are also responsible for significant differences in land productivity in the entire district.

There is a need to introduce new infrastructure and efficient use of existing people in rural areas. The resolution of regional inequalities is not said to equalize the provisions of each infrastructure, but rather specifies the provision of those areas which are specific. Improvement in institutional mechanisms can lead to a long way to improve agricultural productivity. Using the Economic Index, the infrastructure index has proved to be a positive determinant of agricultural productivity. The maximum use of existing infrastructure is the result of a combination of factors. Some basic infrastructure is conditional on the availability and quality of other infrastructure and it is possible that the lowest common divider determines the overall use of the infrastructure.

Thus, rural infrastructure affects direct agricultural productivity through improving infrastructure. Therefore, by assessing the importance of the use of infrastructure, many important points can be brought forward, if the focus remains only in addition to the shares of the infrastructure. Apart from this, better use of existing structures in strengthening human capital and increasing awareness of information is better. In this way, the study throws evidence in support of greater investment in infrastructure in rural areas, as well as steps to maximize the use of existing resources.

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