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EXAMINING THE INTERLINKAGES BETWEEN REGIONAL INFRASTRUCTURE DISPARITIES, ECONOMIC GROWTH, AND POVERTY: A CASE OF INDIAN STATES

ABSTRACT: *This paper investigates the interlinkages between regional infrastructure disparities, economic growth, and poverty in the 21 major Indian States. An overall comprehensive index of infrastructure, the Composite Infrastructure Index (CII), is calculated for each Indian state using the Principal Component Analysis technique. In order to analyse the regional disparities between states in terms of infrastructure, they are ranked based on the calculated CII. We extend our analysis by evaluating the inter-relationship between the Composite Infrastructure Index, Per Capita Net State Domestic Product (PCNSDP), and poverty. The empirical analysis also proves that composite infrastructural growth and economic growth go hand in hand.*

KEY WORDS: *Health, Education, Infrastructure, Composite Infrastructure Index, Principal Component Analysis*

JEL CLASSIFICATION: H54, H75, I32

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1. INTRODUCTION

India, as a republic, is now more than 60 years old and has seen both good times and periods of turbulence. These years have seen the development of a lively democracy and society where Indians have achieved excellence in most spheres of life. However, there are constraints on the growth of the nation, which mean that the Indian economy is unfulfilled and has yet to realise its true potential. The comparative performance of individual states has become one of most important areas of research. Given the regional disparities in India, a study of Indian states is important if the country is to continue to develop economically in a balanced way.

In this paper we have compared Indian states in terms of infrastructure, based on the major sectors of health, education, transport, agriculture, and energy. The economic development of a nation relies heavily on the accessibility and ease of access to the facilities provided by these sectors. Health facilities comprise medical care, nutrition, and water supply; education pertains to quality of educational institutes, literacy rate etc. Health and education are instrumental in improving human development and accelerating economic development. In transport, roads and railways need to be developed first of all. Agriculture is one of the sectors on which the Indian economy depends and remains a major source of income for many, and so requires special attention. Finally, energy is a sector that needs consistent development and progress. Thus the basic human requirements are to live a long and healthy life due to the health sector, to be well educated by the education sector, and have access to the resources required for a decent standard of living via good transport, continuous electricity from the energy sector, and healthy crops from the agriculture sector. The absence of these facilities results in an alarming trend of socio-economic disparity. In India, wide inter-state and intra-state disparities in economic and human development are posing questions about the authenticity of the growth process.

Economic development and human development are interrelated. In India the results of economic development are not being passed on to its citizens and consequently human development is being held back. This uneven distribution, together with unsuccessful policies and plans for major social sectors like education, health, and infrastructure, has led to Indian states performing poorly. The illiterate and sick have become socially excluded and economically disabled, and it is increasingly necessary that the economic gains from development be passed on to the disadvantaged so that they also can benefit from the economic opportunities. Therefore, a study analysing disparities between the states in health,

education, transport, agriculture, and energy is all the more important. Each of these sectors is compound and requires the coordinated efforts of both public and private sectors, given the massive size of resources required to improve the situation and remove the disparities. The public sector has the dual responsibility of creating the necessary policy environment, which must be both effective and efficient, and providing the required resources. Each of these sectors plays an important role in the development of the states, and ultimately of the nation.

Human capital has been defined as one of the significant factors of development in the endogenous growth model. Most of the literature on human capital focuses on the critical dual partnership of education and health. Good quality education and a sound health system are vital elements in the economic growth of a nation. Health in the form of life expectancy has been observed in many cross-country and inter-state analyses to have a considerable positive effect on the rate of economic development (Bloom and Canning 2000, 2001). Bloom et al (2001) showed that good sound health has a positive, substantial, and significant impact on overall output across the Indian states. The education sector contributes to the economy in a different way. Citizens can only become competent, both knowledge-wise and skill-wise, through education, and thus education contributes to the growth of the economy. For this reason it is important to explore educational disparities across Indian states. These are the reasons for carrying out this analysis and constructing an infrastructure index.

There have been studies in the literature emphasizing that infrastructure is a key catalyst for economic growth and development. Infrastructure passes on both direct and indirect benefits to society, along with a chain of positive externalities. A state achieves the foundations of a strong infrastructure by improving communications, transport, and other utility sectors that generate employment. Infrastructure links firms and expands economic activity by decreasing production costs, and as the infrastructure becomes efficient it attracts both domestic and foreign investors and increases economies of scale. Empirical evidence also suggests that investment in public infrastructure results in greater economic output, higher employment, and better quality of life (Bougheas et al. 1999, Cutanda and Patricio 1994, Esfahani et al. 2003. Looney 1997, World Bank 1994). By studying the disparities between the Indian states in these major sectors we hope to make some key findings.

We analyse the performance of the 21 major Indian states in health, education, transport, agriculture, and energy. The 21 states were chosen based on size, population, and data availability. We ranked these 21 states and observed their

infrastructure performance across the five sectors. The second part of our analysis examines the linkages between infrastructure, economic growth, and poverty.

Section 2 summarizes the important literature on this topic. Data and methodology relevant to this study are discussed in section 3. The results of the empirical analysis are illustrated and reported in section 4. The conclusions of the study are given in section 5. The policy implications are reported in section 6, while section 7 discusses the scope for further study.

2. LITERATURE REVIEW

There is a vast literature pertaining to disparities in terms of health, education, transport, agriculture, and energy. Chand and Puri (1983) discussed regional inequalities in the world and the experiences of various developed and developing nations, with emphasis on India. Their main aim was to examine the effectiveness of policies regarding the focal issues of regional inequality and balanced regional development. The study also discussed the disparities between various states with respect to per capita income, transport, communication, industrial growth, and developed banking facilities. It developed a multidimensional index of development based on various parameters to present a complete picture of inter-state disparity. The research also analysed the effect of the Indian government's industrial licensing policy and the policies of the banks and other financial institutions in decreasing regional disparities. Dadabhavi and Bagalkoti (1994) laid particular emphasis on the role of government in reducing regional disparities in health through an increase in investment in health infrastructure and education infrastructure, especially female education in the rural areas of the less developed regions of lagging states.

Bagchi and Kurian (2005) discussed regional disparities in India measured by income, poverty, electricity consumption per capita, telephones, motor vehicles, urbanization, female literacy, infant mortality, and total fertility, and compared disparities across the pre-reform (1981-82 to 1990-91) and post-reform(1991-92 to 2010-11) periods. Various other factors responsible for escalating regional disparities were discussed in the paper. The research pointed out some policy-driven solutions, such as improving the capability of the poorer states to increase their spending on social and economic services, increased investment in backward states, etc. Dadabhavi and Bagalkoti (2006) used the coefficient of variation method to analyse the disparities between the income levels and growth of India's key 17 states during the post-reform period. The study analysed

the 17 states from 1976-1978 and 1990-1992 and discussed the effect of per capita income, health infrastructure availability, literacy rate, and public expenditure on the health status of society. Supported by the increasing coefficient of variance, they showed that inequality across states is increasing. They estimated various measures of convergence and divergence to determine regional inequality. The paper emphasised providing improving measures like attracting more resources, developing a facilitating environment by investing in agriculture, developing basic infrastructural facilities like transport in backward states, and improving governance.

Mathur (2006) discussed disparities in regional development by analysing trends in growth of per capita state domestic product, poverty, and infrastructure development, and described the trend of regional inequality between primary, secondary, and tertiary sectors. The paper also discussed the effect of economic reforms on regional development. Kaushiva (2007) investigated the disparities between states on indicators pertaining to growth of gross state domestic product, poverty, investment level, human development, and infrastructure development. The research showed that in spite of the planning commission adopting various policies, states like Bihar, Madhya-Pradesh, Rajasthan, and Uttar-Pradesh (BIMARU states) have experienced low growth, slow poverty reduction, and a low human development index, and in the post-reform period had a very low percentage share of total foreign direct investment.

Chauhan et al. (2008) investigated inter-regional disparities in income level and tried to find out whether regional disparities were rising or declining between 1960 and 2005. Per capita state domestic product was again taken as the major indicator of income. The study also examined the social and demographic factors which are majorly accountable for convergence and divergence of per capita state domestic product among the Indian states. Finally, the study recommended policy measures such as the creation of new states from backward states, improving the social and economic infrastructure to give a push to the lagging states, and initiating policies to break the cycle of poverty and backwardness by empowering women, achieving good governance, and boosting foreign direct investment in the backward regions. Radhakrishna and Rao (2006) discussed the inter-state disparity scenario in a rural- urban poverty faceoff among scheduled castes and scheduled tribes. The study tried to analyse the occurrence and trends of poverty levels and unemployment in the post-reform period in India. It also described inter-state variations in the human development index (HDI), human poverty index (HPI), and rural poverty reduction. Kumar (2007) explained rural-urban inequalities in the health and education sectors of Uttar Pradesh. Under health

and educational infrastructure, the study examined the disparities in various parameters such as beds, hospitals, primary health centres, (PHCs), doctors, average number of teachers, school buildings, student classrooms, student-teacher ratio, etc. The study recommended an increase in spending at various levels of the health and education sectors, the implementation of more health insurance schemes, and compulsory health education for all girls. Sharma and Sethi (2007) examined the crisis of regional inequalities in economic and social development and studied regional disparities in terms of per capita income, poverty, private investment, and infrastructure development. Developing this analysis, they classified states into two groups, forward and backward states, and showed inter-state disparities.

Dev (2008) analysed the changes that have taken place in inter-state and intra-state disparities. The indicators chosen were growth rate of gross state domestic product (GSDP), per capita gross state domestic product, income poverty, underweight children, infant mortality rate (IMR), and net enrolment rate in the pre-reform and post-reform periods. The study compared India with other Asian countries like Bangladesh, Indonesia, and the Philippines in terms of these indicators. It concluded that regional disparities have increased in the post-reform period, and showed a positive relationship between higher level of infrastructure, per capita income, and capital flows (specifically per capita total investment). The author emphasized the agriculture sector problems in lagging states and recommended adoption of a regionally diversified strategy for tackling them. Singh (2008) analysed disparities in the living standards of various income groups as measured through monthly per capita consumption expenditure (MPCE) in rural as well as urban areas of Indian states. This study was limited to 18 states and the results confirmed the presence of disparities in living standards. The research also concluded that a positive correlation existed between different income groups' MPCE and development levels.

Choudhary (2008) examined regional disparities in educational development in Indian states spanning the 1980s, 1990s, and 2000s. He selected seven major indicators to measure educational development. The study constructed a composite index for educational development by combining primary and upper primary education levels. The Indian states were then ranked by regional disparities. The results revealed that only Kerala had a high level of educational development. States like Karnataka and Maharashtra were found to be moderately developed in levels of education, while Bihar, Orissa, and Uttar Pradesh remained laggards. Choudhary focused specifically on education and considered it an important component of the social sector. He also suggested policy measures such as

increasing public expenditure on education, promotion of a cordial and familiar school environment, and more focus on girl's education in order to achieve a balanced gender growth in the education sector. Ghosal (2008) analysed regional disparities in terms of human development and real per capita income taken as an indicator of economic growth. The analysis was performed on 14 Indian states for the year 1991 when the neo-liberal economic reforms were initiated. The results showed that inter-state disparity was increasing in the growth rate of real per capita income and decreasing in levels of human development during the study period of liberalization. Ghosal used cross-state regression analysis, which reaffirmed the fact that social sector expenditure by both government and private households was the major reason behind the disparities observed in human development across states. Malhotra and Shweta (2008) revealed that interstate variations in per capita health spending were causing the disparities in health attainment between Indian states. The authors performed this study based on a simple regression analysis which proved that there were direct linkages between per capita public health expenditure and level of regional economic development measured by per capita net state domestic product (PCNSDP).

Thus we can safely conclude that there are specific problems pertaining to every state, and hence the choice of development indicators is not that important. Development is a multidimensional process and every single indicator assumes its own significance when analysing the disparities. In our study we have tried to select an accurate, compact, and systematic set of indicators that provide a realistic analysis of the regional disparities between different Indian states.

3. DATA AND METHODOLOGY

To comprehend and gauge the trend and pattern of regional disparities between Indian states in terms of infrastructure, we have selected the indicators (for the latest time period available) listed below, which will constitute the Overall Infrastructure of an Indian state. Indicators from the sectors of health, education, transport, agriculture, and energy have been selected so as to give a comprehensive view of the Overall Infrastructure. We have analysed 21 states across India, due to unavailability of data on some indicators for the omitted states. Since Telangana state was only formed recently, it was not considered for the analysis.

3.1 Education

- **Literacy Rate (Female, 7 years and above):** The level of literacy is arguably the most important indicator of a society's development. Generally, male literacy is higher than female literacy in India. Therefore, a true and realistic indicator of a state's development is the level of female literacy, which we have taken for all 21 analysed states.
- **Net Enrolment Ratio: Upper Primary Level:** Child education is the basic foundation of a state's development. This indicator gives us a picture of how many children are enrolled at upper primary level out of the total upper primary age group.
- **Mean Years of Schooling of Labour Force (Rural+Urban):** The education level of the labour force is also one of the indicators that gives a clear view of the strength of the education sector of a particular state.
- **Percentages of children (rural) who can read, do arithmetic, and read English:** An indicator giving us a rural picture of children in Indian states and information about their basic educational abilities. The data was available individually for children who can read, children who can read English, and children who can do arithmetic. We have taken the average of these three to arrive at the overall indicator used for our study.
- **Dropout Rates in Classes I-V:** This indicator tells us about the percentage of children who are not able to reach the last stage of levels I-V of education and dropped out in between. It is again a very crucial indicator of education levels.
- **Number of educational institutes (per 10 sq. km of area):** A crucial indicator giving information about the frequency and number of educational institutes in a particular state.

3.2 Health

- **Households Access to Safe Drinking Water:** This indicator tells us about the percentage of households having access to safe drinking water and therefore is important in predicting the reach of basic amenities in terms of health.
- **District Level Household Survey (DLHS) institutional delivery**: This informative indicator is an indication of the percentage of maternal deliveries happening in health institutions.
- **Infant Mortality Rate per 1000 births (IMR)**: The infant mortality rate is a very critical indicator of the quality of health care facilities in a state. The lower the IMR, the better the health infrastructure scenario.

- **Percentage of children under age 3 years born to ever-married women classified as underweight**: This is an indicator which gives the state of underweight children in the age group 0–3 years.
- **Women with Body Mass Index (BMI) below normal – National Family Health Survey (NFHS):** Again, a health indicator which pertains to malnutrition among women**,** through below-normal Body Mass Index
- **Number of government hospitals (per one million of population)**: This indicator gives a good idea of the health infrastructure in terms of frequency of government hospitals.
- **Number of beds (per government hospital)**: This indicator tells us about the state of facilities in government hospitals.
- **Total number of rural health infrastructure institutes (per one million of population)**: This indicator tells about the state of rural infrastructure in health facilities across different Indian states.

3.3 Transport

- **Roads (per 10 sq.km of area):** An indicator which tells us about the level of development of road transport through road length per 10 sq. km area across the Indian states.
- **Railways (per 10 sq.km of area):** An indicator which tells us about the level of development of railway transport and related infrastructure across the Indian states.

3.4 Agriculture

- **Percentage of cultivable land out of total area of the state:** The percentage share of cultivable land out of the total area is a crucial indicator in the sense that it tells us about the amount or the proportion of cultivation taking place in a particular state.
- **Percentage of irrigated area out of total area of the state**: The percentage share of irrigated area out of the total area is an important indicator in terms of the agricultural development of a state. Agriculture being India's major occupation, irrigation not only increases the level of labour absorption but also enhances land productivity.

3.5 Energy

- **Percentage of towns electrified:** This indicator tells us about levels of electrification and reach of electricity to the different towns of particular Indian states.
- **T & D Losses as percentage of availability:** This indicator from the energy sector gives information about transmission and distribution losses as a percentage of available electricity.
- **Gross generation of electricity (MKWh) per one million of population**: This indicator gives information about the generation of electricity per one million of population from a particular state.

We have used all the above mentioned indicators pertaining to the health, education, transport, agriculture, and energy sectors in order to construct a composite infrastructure index (CII). Before constructing the index, all the indicators had to be normalized before the Principal Component Analysis (PCA) was applied to decide the factor loadings and their respective weights.

For normalization, the following formula was employed:

$$NV_{ij} = 1 - \frac{\left(\text{Best } X_i - \text{Observed } X_{ij}\right)}{\left(\text{Best } X_i - \text{Worst } X_i\right)} \quad (1)$$

where NV_{ij} = Normalized value corresponding to the X_{th} indicator, where i = corresponding state and j = corresponding indicator; Best X_i = Best/Maximum value of X_{th} indicator, where I = number corresponding to the state (in this case values of 21 states under the X_{th} indicator will become the i series); Observed X_{ij} = Observed/current value of X_{th} indicator where i = corresponding state and j = corresponding indicator; and Worst X_i = Worst/Lowest value of X_{th} indicator.

The Best and the Worst values rely upon the nature of a particular indicator. For example, if household access to safe drinking water is an indicator having a positive impact on health, in this case the highest value will be treated as the Best value and the lowest will be considered as the Worst value. However, if the indicator is negative, like the infant mortality rate, the lowest value will be considered as the Best value with highest value as Worst value. Once the Normalized Values are obtained for all the indicators across the 21 Indian states, in the next step Factor Loadings and Weights are assigned. Principal Component Analysis (PCA) is used to compute the Factor Loading and Weights of these indicators using the following formula:

$$I = \frac{\sum_{i=1}^{n} X_i \left(\sum_{j=1}^{n} \left| L_{ij} \right| . E_j \right)}{\sum_{i=1}^{n} \left(\sum_{j=1}^{n} \left| L_{ij} \right| . E_j \right)} \quad (2)$$

where I is the Index for a particular category, and X_i is the i_{th} indicator under a particular category. L_{ij} is the factor loading value of the i_{th} variable on the j_{th} factor; E_j is the Eigen value of the j_{th} factor.

4. RESULTS AND DISCUSSION

Using the above methodology, we calculated the composite infrastructure index for the 21 Indian states. The states were then classified based on their CII levels. Tamil Nadu was the leader among all the states, followed by Punjab, Goa, and Kerala.

Table 1: Composite Infrastructure Index (CII) Rankings

States	CII	Rank
Tamil Nadu	0.560	1
Punjab	0.534	2
Goa	0.520	3
Kerala	0.519	4
Maharashtra	0.431	5
West Bengal	0.414	6
Gujarat	0.411	7
Haryana	0.410	8
Uttar Pradesh	0.404	9
Himachal Pradesh	0.364	10
Karnataka	0.351	11
Andhra Pradesh	0.330	12
Assam	0.318	13
Jammu & Kashmir	0.299	14
Rajasthan	0.276	15
Uttarakhand	0.269	16
Bihar	0.257	17
Madhya Pradesh	0.234	18
Orissa	0.211	19
Chhattisgarh	0.194	20
Jharkhand	0.193	21

Source: Author's calculation

We divided the states into infrastructurally sound states and infrastructurally lagging states according to their value in the composite infrastructure index. The infrastructurally sound states have a value higher than the average value (0.357) of the composite infrastructure index, and the infrastructurally lagging states have a lower-than-average value (below 0.357).

The classification as per the average-value criteria was:

Sound states: Tamil Nadu, Punjab, Goa, Kerala, Maharashtra, West Bengal, Gujarat, Haryana, Uttar Pradesh, Himachal Pradesh.

Lagging states: Karnataka, Andhra Pradesh, Assam, Jammu and Kashmir, Rajasthan, Uttarakhand, Bihar, Madhya Pradesh, Orissa, Chhattisgarh, Jharkhand.

Analysing the states by the composite infrastructure index, we can observe huge variations between them. Tamil Nadu has the distinction of being at the top of the list with an overall index score of 0.560. It is 2.905 times the value of the state with the lowest value of the overall development index, Jharkhand, which has an index score of 0.193. The difference between these two extreme overall index scores is 0.367. The mean CII value for all states is 0.357 and the standard deviation is 0.114. This is clear evidence of dispersion or disparities between Indian states with respect to the CII, calculated from the major sectors of health, education, transport, agriculture, and energy.

4.1 Inter-linkages between CII, PCNSDP, and Poverty

We have taken two indicators to see whether the states possessing good infrastructure facilities are actually well off or not in terms of economic growth and poverty: 1) Per Capita Net State Domestic Product (PCNSDP) and 2) Percentage of Population below Poverty line pertaining to a particular Indian state. For Per Capita Net State Domestic Product we have taken the 2011-12 values at constant prices of 2004-2005 in rupees (Crores). The data for percentage of population below poverty line by state was taken for the year 2011/12. This data is provided by India's planning commission and calculated as per Tendulkar's methodology, which computes absolute poverty line based on household consumption and considers poverty not in terms of annual income but in terms of consumption or spending per individual over a certain period for a basket of essential goods. It uses rural, urban, and regional minimum expenditure per capita necessary to survive, and therefore sets different poverty lines for rural and urban areas. These

rural and urban poverty lines are combined to arrive at the overall poverty line figures for a particular Indian state.

The analysis of this data also shows that there is a negative correlation/relationship between PCNSDP and poverty data: if one is high the other is low. We also found a positive correlation between PCNSDP and CII. This is in line with the economic expectations and theory. As we did earlier for the composite infrastructure index, we classified all the 21 states into two groups, developed states and under-developed states, on the basis of PCNSDP and percentage of population below the poverty line. The 'developed states' will have a PCNSDP value higher than the average (41,990 Rs) and the 'under-developed states' will have an income lower than the average (41,990 Rs). For poverty we will have the reverse case; i.e., the well-off states will have a percentage value lower than the average (below19.41%) and the worse-off states will have a value greater than the average (above19.41%).

We analysed the states with respect to CII, PCNSDP, and proportion of population below poverty line. The following results were inferred from the analysis:

- The states with a high CII value – Tamil Nadu, Punjab, Goa, Kerala, Maharashtra, Gujarat, Haryana, Himachal Pradesh - should ideally have a high PCNSDP and low percentage of population below the poverty line. They can be regarded as ideal states, which are sound on infrastructure and income and have low poverty levels.
- The states with a low value of CII, low PCNSDP, and high percentage of population below the poverty line – Assam, Bihar, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, and Orissa - can be regarded as poor performing states, which are lagging behind on infrastructure and income and have high poverty levels.

However, there are inconsistencies. Andhra Pradesh and Uttarakhand have two positive indicators, high CII and low percentage of population below the poverty line, and one negative indicator, low PCNSDP, indicating that income is an issue. Jammu & Kashmir and Rajasthan have one positive indicator - low population of families below the poverty line - and two negative: low CII and low PCNSDP, indicating that they have poverty under check but fall behind on infrastructure and income levels. Uttar Pradesh and West Bengal, on the other hand, have high PCNSDP, but low CII and a high percentage of population below the poverty line, indicating that they are good on income level but fall behind on infrastructure and poverty measurement.

Table 2: Status of 21 Indian States with respect to CII, PCNSDP, and Poverty

State	CII		PCNSDP		Poverty		Overall Sign
	Above Average	Below Average	Above Average	Below Average	Above Average	Below Average	
Andhra Pradesh	*			*		*	€
Assam		*		*	*		φ
Bihar		*		*	*		φ
Chhattisgarh		*		*	*		φ
Goa	*		*			*	√
Gujarat	*		*			*	√
Haryana	*		*			*	√
Himachal Pradesh	*		*			*	√
Jammu & Kashmir		*		*		*	€
Jharkhand		*		*	*		φ
Karnataka		*		*	*		φ
Kerala	*		*			*	√
Madhya Pradesh		*		*	*		φ
Maharashtra	*		*			*	√
Orissa		*		*	*		φ
Punjab	*		*			*	√
Rajasthan		*		*		*	€
Tamil Nadu	*		*			*	√
Uttarakhand	*			*		*	€
Uttar Pradesh		*	*		*		€
West Bengal		*	*		*		€

Source: Author's calculation

Note:

√ represents High CII, High PCNSDP, and Low Poverty (Ideal situation).

Φ represents Low CII, Low PCNSDP, and High Poverty (Worst situation).

€ represents inconsistent relationship between CII, PCNSDP, and Poverty.

In the final part of our analysis we framed a null hypothesis to test whether there is any difference between the rate of economic development and composite infrastructural growth.

Null hypothesis: H_0: There is no difference between the rate of economic development and composite infrastructural growth.

Alternate hypothesis: H_1: There is a difference between the rate of economic growth and composite infrastructural growth.

Pearson's Correlation Coefficient or r is one of the most important parameters to determine the linear dependence between two variables. Using this coefficient, the t-test statistic is calculated by the relation:

$$t^2 = (R^2) *(n-k)/ (1- R^2)*(k-1)$$

where n = number of observations; k=DF= Degrees of Freedom = 2 for our study.

We tested the hypothesis taking as our dependent variable PCNSDP as a proxy for economic development and the calculated Composite Infrastructure Index (CII) as a proxy for composite infrastructural growth. We found that the calculated t-test statistical value is less than the critical value; i.e., 4.303 at a 5% level of significance. Therefore, we fail to reject the null hypothesis and can safely conclude that there is no difference between the rate of economic development and composite infrastructural growth. In other words, composite infrastructural growth and economic development go hand in hand.

5. CONCLUSION

Throughout this paper we have used principal component analysis to compute a composite infrastructure index (CII) for the 21 Indian states by combining individual indicators pertaining to the major sectors of health, education, transport, agriculture, and energy. Analysing these states in terms of the CII, we found that Tamil Nadu has the highest composite infrastructure index score, followed by Punjab (2nd), Goa (3rd), Kerala (4th), and Maharashtra (5th). This tells us that these states are pretty sound in terms of their health, education, transport, agriculture, and energy infrastructure levels.

Regarding health, the first National Human Development Report and the first Social Development Report re-emphasized the fact that healthy states gain a lead over others. The expenditure on socially relevant health programmes is significantly higher in the top-ranking states. Developed states with good health levels also have better social structure organization, which ultimately transfers to inclusive sharing of development benefits. As regards education and other education-related indicators, the dominance of Kerala and Goa in education is a well-known fact, although the bulk of good quality education institutes in

Tamil Nadu, Maharashtra, and Punjab puts them at the top. The IT boom in Tamil Nadu and Maharashtra in the last few decades is a result of the many engineering education institutes in these states. Regarding infrastructure, states with solid and well-defined infrastructure along with related conducive factors have attracted the major proportion of private investment over the last two decades, giving a major boost to their economic growth. State-wise publications from the Department of Industrial Policy and Promotion that give details about private investment proposals show that states like Punjab, Kerala, and Tamil Nadu receive most private investment. These states also have good transport, agriculture, and energy sectors. Thus all the top-ranked states are strong in the various sectors and possess a high level of composite infrastructure. However, some of the BIMARU states like Bihar, Rajasthan, Madhya Pradesh, and Orissa lag behind on CII levels. This is understandable, given that they still lack basic health infrastructure in many of their villages and towns, leading to low positions in health index rankings. These states are also laggards on the education front. Private investment that could strengthen infrastructure has always been low. However, they have begun to attract large private investment proposals, mainly due to the extensive mineral extraction happening in these states, which could help to reduce this difference in economic performance and so help to remove regional disparities across the country.

6. POLICY IMPLICATIONS

The most important factors driving growth come from the health, education, transport, agriculture, and energy sectors, which we have used to construct our composite infrastructure index. Efficient investment in all these sectors would provide the much-needed boost required for economic and human development, which would ultimately result in sustainable and satisfactory economic growth. Our analysis shows that poorer states need to invest extensively in these areas, bearing in mind the scarcity of their resources. One way of doing so would be to increase fiscal transfers from the centre to these lagging states, so that they can achieve the growth needed to attract investment. Such transfers should be connected to any sector-specific investment and policy initiatives already running in these states. Focused investment to expand health and education and improve transport, agriculture, and energy infrastructure will expedite the overall growth prospects of the Indian states, specially the poorer ones. The main objective of improving the major sectors of health, education, transport, agriculture, and energy is to help the poor states emerge from poverty and participate more effectively in the socio-economic process. Only then can we

walk the ideal path of 'economic growth with integrity'. A synchronized plan of action between policymakers and state governments is required to achieve this.

7. SCOPE FOR FURTHER STUDY

In this study we have considered the indicators of the health, education, transport, agriculture, and energy sectors. Depending on feasibility and their importance in terms of the objective of the study, other sectors could also be included. We have analysed only the 21 major Indian states, but the study could be extended to other states and union territories.

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