

Excerpts from Measuring Interstate Differentials in Infrastructure A study undertaken for the Commission by T.C.A. Anant, K.L. Krishna and Uma Roy Chaudhry

INTRODUCTION

1. Over the years our understanding of the development process has changed and with it we have changed the role that is assigned to different agents. However in one area there is virtually no change, which is in the centrality of state policy to the provisioning of infrastructure. Adequate infrastructure Physical or Economic, Social, and Institutional - is treated as the basic pre-requisite for sustained economic development.

2. In this study we seek to develop indices of infrastructural availability at the level of different states mainly for the years 1985 and 1990. These indices will reflect the divergence of a state from the all India average. In this coverage we exclude Union territories. Infrastructure can be measured in different ways: in terms of investment, output or results or in terms of the availability of facilities. In this study we focus on the availability of facilities as the basis for analysis.

CONCEPTS AND METHODOLOGY

3. The availability of adequate infrastructure is taken as the fundamental cornerstone of development strategy. The availability of adequate transportation facilities, power, communications, etc. are taken as essential preconditions by any entrepreneur deciding on an investment project in any region. Similarly the availability of skilled manpower and decent living conditions are also important considerations in such location decisions.

4. The end of the second world war with the associated process of decolonization saw rapid growth in and proliferation of theories of economic development, chief among these were Rosenstein-Rodan's "Big Push", Nurkse's "Balanced Growth", Rostow's "Take off into Sustained Growth" and Leibenstein's "Critical Minimum effort Thesis". The common theme of all these theories was an aggregative framework of analysis and identifying the process of growth and development with large and discrete injections of investment particularly in areas with strong external economies and economies of scale. Consequently the provision of social overhead capital or infrastructure was a significant component of such models.

DEFINITION OF INFRASTRUCTURE

5. The concept of Infrastructure has itself gone through changes over time. These changes reflect the deepening of the concept of development and the process of economic development. In current thinking there are three important aspects to the concept of infrastructure.

PHYSICAL INFRASTRUCTURE

6. In the 1940's and 50's when the concept was first formulated, it was conceived as a set of physical facilities without which an integrated, interdependent modern economy could not function. This emphasis on physical infrastructure was based on the following characteristics of these facilities.

- * They involve technological indivisibilities and considerable lumpiness in investment.

- * The investment projects have long gestation lags, this often follows from the sheer size of these investments.
- * They are subject to substantial external economies and diseconomies through the interdependence of economic activities or even of infrastructure facilities themselves.

SOCIAL INFRASTRUCTURE

7. The identification of infrastructure with only physical capital was considered inadequate for two main reasons. Firstly there was the recognition of the importance of human capital in the growth process. Human capital effects growth both through its effects on innovations and technological change as well as increases in labour productivity. Investment in Human Capital has similar features and characteristics of physical infrastructural investment outlined above. For example investments in the areas of Health, Education, Water Supply, Housing, etc. have all got marked public good characteristics. They have strong linkages with each other and with physical productivity, for example literacy is an important requirement for the adoption and spread of Public Health measures, Health and Literacy have direct effects on productivity. Investments in these areas have long gestation lags sometimes even longer than in the case of physical infrastructure. The second reason was a dissatisfaction with the identification of economic growth measured in terms of national product. This dissatisfaction was on two grounds. Firstly that considerations of equity would focus attention on a number of issues of basic need like health and education. Further the recognition that quality of life is not perfectly related to measures of income and hence these other factors better proxy other needs of human society.

INSTITUTIONAL INFRASTRUCTURE

8. In recent times the emphasis of development strategy has shifted from state control to market friendly mechanism. This has highlighted the importance of institutions of governance and regulation as well as of agencies which facilitate the flow of information and investible resources. The importance of administrative systems, legal mechanisms, public safety have long been recognized as important preconditions to growth and development. But in addition to these institutions like banks and financial institutions, Insurance agencies etc. can also be seen to play critical infrastructural roles. Banks and Financial Institutions mobilize capital, help in reducing risk and can assist in information flows regarding a number of economic activities.

MEASURING INFRASTRUCTURE

9. We have three broad methods available to measure infrastructure in a country or region. Each of these have their own limitations and advantages. Each measure can be justified depending on the ultimate use to which it is to be put. In this report the basic premise is to calculate a measure which is related to the activity of the government.

INDIRECT MEASUREMENT VIA EFFECTS

10. One possibility would be to measure the extent of infrastructure in terms of utilization and results. It is instructive to consider some examples: in the case of social infrastructure we could focus on literacy or mortality statistics. In the case of transportation by the value added in that sector. Or for physical infrastructure as a whole in terms of the domestic product of the state or a given region. This method has a number of advantages, first it cuts out most intermediate measurement issues and directly focusses on the results of interest. However the link between the facility and result is not given by a precise invertible mathematical result but is influenced by a number of other socio-cultural factors. For example, the availability of schools and teachers translates to literacy through a complex of factors related to attitudes to education, the degree of economic development, the growth of opportunities to take advantage of literacy and so on. The interlinkages across infrastructural facilities create their own problem of interpretation since shortfalls in one area, say power, can significantly reduce domestic product which in all other respects the state may be very well endowed.

INVESTMENT BASED MEASURES

11. We can define the amount of infrastructural facilities available in a state in terms of the amount of investment that is undertaken for this purpose. This would have two main advantages, first it is possible to directly compare different states on availability in terms of a single linear additive measure namely money. It also has the advantage that different types of facilities are directly reduced to a single common denominator. The main difficulty with this approach is that the amount of money allocated in a given year reflects both maintenance and new investment expenditures, even if we could separate out the two, the conversion from monetary units to physical stock is problematic. The amount of physical stock generated is influenced by both prices or cost and the time taken to implement the project. Over the years infrastructure investments have been notorious for both cost and time overruns both of which are almost impossible to quantify.

12. On balance, our assessment is that these measures outlined above while useful in certain contexts are not helpful in devising a measure which can identify the extent and nature of action required at the level of states in the Union. Thus we focus attention in this report on the last measure, namely, that based on a direct enumeration of available facilities.

FACILITIES BASED MEASURES

13. In this approach the measure seeks to directly quantify the amount of different facilities available. In doing so we confront two major problems. The first relates to the aggregation problem as we will attempt to build a unique or small group of measures from a number of disparate measures. Before we deal with this issue, we must examine the second and equally important conceptual issue. The biggest problem with a facilities orientation is that it is almost impossible to control for differences in quality. For example a village may be electrified but effectively no power is delivered because of poor maintenance; the roads may exist but again may be in such poor condition that they are not useful for any major traffic; a teacher may himself be semi or illiterate and so on. This problem is further compounded if these differences are not homogeneously distributed across states. In this exercise we assume, for want of any information in this regard, that the quality effects are similarly placed in different states.

14. In this report we measure the infrastructure facilities available in different states in terms of eight major sectors:

1. Agriculture
2. Banking
3. Electricity
4. Transport
5. Communications
6. Education
7. Health
8. Civil Administration

15. These are further classified under three heads: Economic Infrastructure(1-5), Social Infrastructure (6&7), and Administrative Infrastructure. The choice of these sectors was influenced both by the conceptual considerations outlined earlier and availability of data.

METHODOLOGY

16. A key factor limiting our selection and use of variables was the lack of availability of consistent data for all states in the Union. If data for a given year was not available then the data for the closest available year was chosen. However, in some cases data for 1990 or later is not available, in which case the most recent year possible has been selected. In selecting variables the primary consideration was to preserve the capital good and public good character of the concept of infrastructure.

17. The data was first standardized by deflating the numbers by a suitable deflator. In some cases the choice of deflator was governed by some natural criteria, as in total number of villages for data on villages electrified, or cultivated area for data on net area irrigated. Where such natural deflators were not available then given our concern with availability we have used either population in million or the area of the state in thousand square kilometers. Our preference has been to focus on area unless there are compelling reasons to use population. Occasionally we have in fact used both. The choice was based on the considerations that both distance and congestion are access costs. However congestion can be reduced by improvements in quality or size. Thus in the absence of data on size distribution or quality distribution of these facilities population will be more misleading than a distance based cost. Where this argument was not compelling we have used both measures, as in the case of hospital beds or in the case of administrative measures. The standardized variable was then converted into an index number by deflating with the All-India value of that year. This implies that the index numbers reflect the deviation in a state from the All India availability of that resource.

18. The next step was to devise an aggregation procedure at the sectoral level. For this purpose we restricted attention to the eighteen largest states in terms of population. This was done as the data on the smaller states tended to have numerous gaps. Further the most complete data set is available for all variables only for 1985, hence all statistical analysis was done on this year. As a first step the 1985 data for 18 major states was analyzed to calculate the first principal component. The eigenvector corresponding to this component was standardized so as to sum up to unity. Using the eigenvector based weights sectoral indices were calculated for both 1985 and 1990. If for a given state some variables were missing in any year the weight for

those variables was redistributed amongst the other variables. This general procedure was used in all the above cases except agriculture (where no aggregation was needed), education, banking and administration.

19. The sectoral indices were aggregated into an aggregate index of infrastructure. In a fundamental sense all these infrastructural facilities are critical for the process of development. For this purpose we identified the concept of development with state domestic product. Therefore, in order to examine the issue of assigning weights we looked at the correlation of these different variables with an index of state domestic product per capita. This index was generated by calculating a three year average of the SDP's of different states and converting the resulting SDP per capita into an index with all India value set at 100. The weights for the sectoral values were then constructed in proportion to the correlation of the sectoral variable with the SDP index.

20. It must be noted that the index number so created does not reflect availability. Further increases or decreases in the absolute value does not imply that the state has seen an increase or decrease in its absolute infrastructural facilities but that it has seen a growth which is lower than the average growth recorded.

DATA SOURCES

21. Data on net irrigated area for all states have been collected from 'Basic Statistics Relating to the Indian Economy', Vol. II, States (CMIE, September, 1992), for the years 1985-86 and 1987-88.

22. This is also the main source of information for "Installed capacity," "Number of Villages Electrified," and "Consumption of Electricity" (Utilities only). The information is available for 1985-86 and 1991-92 for the first two items and for 1990-91 for the last i.e. consumption of electricity. Data are available consistently for all the states except for Goa. Data on "Length of Transmission and Distribution Lines" by States are taken from "Public Electricity Supply, All-India Statistics-General Review."

23. Data on "Statewise Distribution of Commercial Bank Offices" and "Number of branches of Regional Rural Banks" are obtained from "The Report on Currency and Finance," Vol II, Statistical Statements, (Reserve Bank of India). Distribution of Offices of Cooperative Banks in Different States are from "Statistical Tables Relating to Banks in India" (Reserve Bank of India) and is inclusive of State, Central and Primary Cooperative Banks. The latest year for which data are available is 1988 except for Goa and Mizoram for which data even for 1985 are not available. In the case of Regional Rural Banks, the latest year for which data are available for all the states is 1989 except for Goa and Sikkim for which no data on this category of bank services are available. For Commercial Bank Offices the position is very satisfactory with data for all the states being available till 1991.

24. "Basic Road Statistics of India", Transport Research Division, Ministry of Surface Transport is the source for all data on road length as well as villages connected by all weather roads. The data are available for all the states with 1988 as the latest year. Information on railway route length and registered motor vehicles are obtained from 'Basic Statistics Relating to the Indian Economy,' Vol II, States (CMIE September 1992). In both the cases data are available for all the States for the years, 1985-86 and 1990-91.

25. Data on both post offices and telephones connected to the Departmental Network by States are taken from different issues of "Basic Statistics Relating to the Indian Economy," Vol. II, States (CMIE). The latest data available is for 1990.

26. In the case of 'Number of Telephones connected to the Departmental Network,' the 1985-86 data have the information of northwestern States appear in the form of the total figure for Haryana, Himachal Pradesh and Punjab and for northeastern States of Manipur, Meghalaya, Nagaland, Tripura are clubbed with Assam. For 1990-91, the northeastern States of Manipur, Meghalaya, Nagaland and Tripura are presented together. In these cases the figures are distributed between the states using the proportions for the year for which details are available.

27. Data on the number of "Primary Institutions" and "All Types of Institutions" are taken from "Education in India, Vol I, Ministry of Education. The latest year for which data are available is 1985. The data on non-primary institutions are calculated from the above two. As regards the data on the "Number of teachers per unit of the population in the relevant age group" (primary 8-11 years, middle 11-14 years & higher secondary 14-17/18 years) the ratios have been worked out using the two series of teachers and population from independent sources.

28. Data on "Number of beds in Hospitals and Dispensaries" are collected from "Basic Statistics Relating to the Indian Economy, Vol. II., States (CMIE, September 1992)". The latest year for which information is available is 1989. The data on "Number of Primary Health centres and subcentres" is obtained using both "Health Information in India," and "Health Statistics in India," both published by the Ministry of Health. The latest year for which information is available is 1990. However, no data are available for Goa and Arunachal Pradesh for 1980.

29. Finally we have collected data on some key variables describing a state, namely population, area and number of villages. These were used primarily as a basis for standardisation. The population data was drawn from various issues of the Report of Currency and Finance. Area of states was obtained from the September issues of CMIE, "Basic Statistics Relating to the Indian Economy, Vol In, States (1992)". The data on number of villages in a state was drawn from "Basic Road Statistics of India".