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Indexing Human Development in India: Indicators, Scaling and Composition

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Abstract

The paper analyses methodological issues concerning selection of indicators, making them scale-free and construction of composite indices within the framework of measuring human development. It reviews the existing literature in the area and highlights the key areas of concern from the viewpoint of methodology of aggregation. It discusses the implications of the assumptions underlying different techniques, currently being used in India, in the context of an empirical exercise of constructing an index of human development at state level. It examines the advantages and disadvantages of these techniques and proposes improvements therein for bringing them closer to empirical reality and thereby increasing their acceptability among the planners and policy-makers. The study suggests that exercises at determining the levels of human development at the state or district level by official agencies like the Planning Commission, concerned ministries or an international agency must enjoy large acceptability so that these can be used in policy-making. Agreements must be obtained in terms of choice of indicators, scaling, methodology of composition, etc. Establishing certain degree of uniformity in methodology through deliberations in a committee at the highest level (as was done in case of measuring poverty) will accord credence to the results and help clear the uncertainty and inconclusiveness that characterise the current debate.

JEL Classification

C13, C43

Keywords

Human development; Indexing; Estimation

1. INTRODUCTION

The concept of human development is as old as the economic thought itself but its quantitative measurement is of recent origin. The former can be traced back to the oriental societies as their objectives have always been to maintain, improve and provide the basic requirements of nutrition, living space and social harmony. Even the ancient scripts such as *Arthashastra* by Kautilya can be seen as a treatise of human development as it discusses systems of governance that can ensure certain welfare standards to all the sections of population. Similarly, Adam Smith in his *The Wealth of Nations* emphasises on state investment in education and other social areas as, he felt that private entrepreneurs motivated by profit maximisation may not make adequate investment in these sectors. At the root of his proposition of laissez-faire lies the intent of the good for common man and he cautions the state that inefficiencies in the system may damage the common cause.

The assessment of economic value of total production in a country during certain period has traditionally been done by an accounting process that evaluates 'domestic product' in terms of prices obtaining in the market. The progress of a nation and its economic development has, therefore, been measured in monetary value and expressed through a common denominator across countries. The GDP or NDP has been considered a reasonably good measure to determine the nation's wealth and economic performance over time. The inadequacies of this measure have, however, been noted right from the time of its use for cross-country comparisons. Scholars have pointed out that this unidimensional estimate does not capture the achievements or failures of the efforts of a society in providing welfare to its people for a large numer of reasons. Despite these inadequacies, cross country comparisons continue to be made on the basis of per capita GDP. It is common for the multilateral and bilateral agencies to take the latter as the basis in charting out plans and strategies for funding development projects aiming to increase equity among the regions and among the population groups. The inadequacy of such comparisons as also the need to define ‘development’ as a multidimensional and multifaceted concept has, however, been recognised by large segment of policy-makers and researchers all around the globe in the recent decades. This understandably has brought forth the necessity to consider a set of indicators pertaining to the different dimensions of development and their composition into an aggregative index.

Regional planners and geographers and to a lesser extent the development economists in India have been constructing composite indices since the early years of the present century.

The issues concerning database, selection of indicators, making them scale free and assigning weightages have received some attention of the researchers and policy-makers although many of these remain unresolved. The problems due to lack of objectivity in choosing the indicators and assigning them weightages has limited the applicability of these indices in development policy, particularly for the purposes of resource allocation. Economists have shown considerable reluctance to use the methods for obtaining a composite ranking of the arial units based on the rankings by a large number of indicators, on the ground of theoretical legitimacy. The famous *Impossibility Theorem* of Kenneth J. Arrow, which challenged the theoretical foundation of working out a unique social ordering based on the orderings of a number of individuals, has proved to be an obstacle for any such composition exercise for quite some time.

The needs of development policy have, however, proved to be a strong motivation for keeping the interest in composite indices alive. Of late, however, a number of economists and policy planners have shown willingness to go beyond the formal limits of theory and exercise judgements about the weightages to be assigned to the indicators for working out a composite ranking. With the publication of *Human Development Report* (HDR), such exercises have got a big boost. The enthusiasm with which the HDRs have been received in different countries and in different disciplines confirms the relevance of such exercises. Presently, composite indices are being built for different dimensions of social and human development and at different levels of aggregation.

The methodological issues of scaling and composition, however, have remained by and large unanswered. The technique of making indicators of human development, relating to income, literacy and life expectancy, scale free through range equalisation method and their aggregation by giving equal weightages have not been adequately defended in the Human Development Report. Despite unhappiness being expressed by a few researchers, no comprehensive effort has been made to pose the issues of measurement in a clear perspective, resolve the prevailing controversies and obtain some kind of consensus on the approach or methodology.

The popularity of HDR has prompted a number of research institutions and scholars to build up similar indices at the state and even at the district level without getting into the methodological debate. Understandably, the question of database becomes far more complex when composition exercises had to be done at sub-national level.

Despite the current usage of these indices in policy discussions, it is disappointing to note their limited use in resource allocation and programme implementation. This, to an extent, is due to the methodological issues not being resolved with adequate clarity. It would also be important to establish the relevance of such indices in policy formulation and programme implementation while resolving these methodological controversies.

Keeping the above in view, the present paper proposes to go into a few of the methodological issues and examine these in the context of available database, levels of aggregation and usage in development policy. The proposed study begins by reviewing the methodological literature on the subject and highlights the key areas of concern. It then discusses the implications of the assumptions underlying different techniques in the context of the empirical reality. It also analyses the advantages and disadvantages of alternative methods and proposes improvements therein for bringing them closer to empirical reality and thereby increasing their acceptability among the planners and policy-makers.

It would be useful to refer to the debate on measurement of poverty in this context. Conceptually, measuring poverty is easier than human development because the former is linked with nutritional deprivation, measured through calorie intake. All the scholars quoted have similar methodology — taking a minimum calorie norm, converting that into consumption expenditure, taking that as poverty line, updating it by certain price index over time and getting the estimates of people below the poverty line using the NSSO consumption expenditure data. There is, thus, no problem of multiplicity of indicators or assigning weightage to them. Despite this, the estimates worked out by researchers, within and outside the government, have varied widely. The difference often differed beyond two digit figures. In view of these discrepancies, Planning Commission had set up an Expert Group (Planning Commission, 1993) on measuring poverty with the objective of resolving these methodological issues and standardising the procedures. This report of the Expert Group has been widely acclaimed and found useful in poverty debate. Indeed, this has set to rest a number of controversies and cleared quite a bit of unnecessary confusion. Also, it has made an attempt to make the poverty index a useful input in development policy.

This study has a similar objective of clarifying the issues and making the methodology of measuring human development more relevant to the given empirical reality. The task nonetheless is much more challenging as it involves choice of a number of indicators and determining their relative importance. This study would sort out many of the issues concerning scaling and composition and resolve some of the controversies and propose suitable modifications in the traditional indices. It would use NCAER database and other database for clarification and illustration purposes.

This paper spans over five substantive sections. Section 2 reviews the literature and critically evaluates the techniques that are currently being used, including the method adopted by UNDP for indexing human development. Section 3 examines the alternative methods of scaling of indicators and giving them weightages, available in the present literature while highlighting their limitations. An axiomatic framework for measuring the level of development in India at the state level is proposed in Section 4. It then presents the techniques adopted in the study for this purpose and gives reason for their selection. Section 5 discusses the indicators identified and presents the results obtained by using the alternate methods of composition. It goes on to analyse the regional scenario of development using the sectoral as well as aggregative composite indices. It thus, attempts a sensitivity analysis based on varied sets of assumptions and examines their impact on the results. Section 6 presents the policy implications of this study.

2. MEASURING DEVELOPMENT AS A MULTIDIMENSIONAL CONCEPT: METHODOLOGICAL ISSUES

It becomes evident from an overview of development literature that development cannot be measured through income alone. It manifests in a number of dimensions such as in human health, longevity, literacy and a certain level of standard of living that must be incorporated in any measurement exercise. The indicators selected for these dimensions, therefore, must articulate aspects of development that are conventionally missed out. However, there will be difficulties in determining the number of indicators that would adequately capture the shades of meaning associated with development. Indeed, there are parameters such as freedom from fear, freedom of choice, freedom to profess religious duties, freedom of information, freedom to participate in political activities and so on. But getting dependable information on these parameters is difficult. For making the index useful and acceptable in policy making, it would be desirable to include only those indicators that are amenable to measurement and statistical analysis.

Human development indices should attempt to evaluate the achievements of growth and development in terms of improvement in quality of life of masses and overall development of society and environment. The indices can, therefore, be used to assess the level of success of development programs implemented by the national and state governments as well as those proposed by the multilateral and bilateral aid agencies and international civil society organisations. The UNDP has spearheaded the initiative to compute the Human Development Index (HDI) which encompasses besides physical income two other aspects that reflect health and educational development, viz. life expectancy at birth and adult literacy. This has encouraged efforts to develop human development indicators and indices at sub-regional and local levels (possibly keeping in mind the recent innovations of governance effected through the 73rd and 74th constitutional amendments that makes decentralisation mandatory), a part of it being sponsored by the UNDP .

The Human Development Reports (HDRs), published annually by United Nations Development Programme (UNDP) since 1990, have brought into focus that the objective of development is not simply to produce more goods and services for material enrichment, but to increase the capabilities of people to lead full, productive and satisfying lives. What is of basic concern is the ability of people to lead a long and healthy life, to have access to knowledge and sufficient income to buy adequate amounts of food, clothing, shelter and other basic amenities.

Keeping in view the objectives of development across countries, the HDRs identified three areas of social concern, viz. education, health and material well-being. For each of these areas, the reports have identified the following suitable indicators to measure progress.

- Life expectancy at birth for health.
- Adult literacy rate for education.
- Per capita income with declining marginal utility for material well-being.

The relative performance of a country in an area of concern is measured with reference to the 'maximum' and 'minimum' values of the concerned indicator. Division of the value of the country by the range, viz. the difference between the maximum and the minimum, is expected to make it "*scale free*". The scale free values of the three indexes are then combined, equal weightage is given to each, to get the Human Development Index (HDI) for the country.

The first HDR released in 1990, revealed that there is no automatic link between economic growth and human progress. Modest levels of income in case of several countries were found to be translating into fairly respectable levels of human development. The 1990 HDR, therefore, recommended a social development approach within this framework of popular and NGO participation. Understandably, some of the conceptual and measurement aspects of the human development index came under criticisms, following the release of the 1990 HDR. The UNDP have responded to these criticisms by making refinements in the indicators as also methodology of measurement. Notwithstanding all these, the objective of achieving a reasonable level of HDI has brought about reallocation of resources in several countries to match the priorities of human development.

An important omission frequently pointed out by critics is the dimension of freedom. Dasgupta has criticised the HDI for neglecting human rights: "As a measure of human development, it is quite incomplete; it is oblivious of what is commonplace to call human rights" (Dasgupta, 1990). It is only in the HDR 2000 that this figures prominently. The second criticism was ignoring aspects of political volatility. The HDI is based on relatively stable indicators, which do not change dramatically from year to year. Political freedom, by contrast, can appear or vanish abruptly. Therefore the HDR 1992 considered political freedom separately, emphasising an adequate methodology for constructing an index of political freedom or of human rights performance.

For longevity, life expectancy at birth has been widely accepted as an indicator of development. But it has been suggested that infant mortality should complement life expectancy, particularly in developing countries. Further, empirical analyses show that life expectancy fails to discriminate among the industrial countries. Keeping all these in view, UNDP has been in the process of refinement or modification of the index. Although the basic concept of development and the methodological parameters have remained by and large unchanged over time, there have been modifications in the specific indicators. The summary of the changes is presented in Statement 1.

STATEMENT 1
Changes in the Choice of Indicators for HDI Estimates Used by the UNDP (1990–200)

<table>
<tr><th>Year</th><th>Income</th><th>Education</th><th>Health</th></tr>
<tr><td>1990</td><td>Log of real GDP per capita</td><td>Adult Literacy Rate</td><td>Life Expectancy at Birth</td></tr>
<tr><td>1991</td><td>Atkinson formula using real GDP per capita
$W(y) = y$ for $0<y\leq y^*$
$= y^* + 2(y-y^*)^{1/2}$ for $y^*\leq y\leq 2y^*$
$= y^* + 2(y^*)^{1/2} + 3(y-2y^*)^{1/3}$ for $2y^*\leq y\leq 3y^*$
and so on.
Where y* is the poverty line and the full income is divided into multiples of poverty line.</td><td>Education = a* Literacy Rate + b* Mean Years of Schooling
where a=2/3, b=1/3.</td><td>-do-</td></tr>
<tr><td>1992</td><td>-do-</td><td>-do-</td><td>-do-</td></tr>
<tr><td>1993</td><td>-do-</td><td>-do-</td><td>-do-</td></tr>
<tr><td>1994</td><td colspan="3">No change in the methodology nor in indicators. Except, the maximum and minimum values have been fixed for the four basic indicators.
The threshold value is taken to be the global average real GDP per capita (PPP$40,000 and $200).
Adult literacy (100% and 0%)
Mean years of schooling (15 and 0 years).
Life Expectancy (85 and 25 years).</td></tr>
</table>

1995	Minimum value of income has been revised from PPP$200 to PPP$100.	The indicator mean years of schooling has been replaced by the combined primary, secondary and tertiary enrolment ratios (max value 100% and the min value 0%).	-do-
1996	-do-	-do-	-do-
1997	-do-	-do-	-do-
1998	-do-	-do-	-do-
1999	Log of real GDP per capita	-do-	-do-
2000	-do-	-do-	-do-

Source: Human Development Report, UNDP, Different Years.

For the educational dimension, the 1990 Report used adult literacy rate as the sole indicator. It was, however, argued that functional literacy is often less than recorded literacy, especially in industrial countries. Also, this indicator fails to discriminate among industrial countries. Consequently, 'mean years of schooling' was added to adult literacy since 1991. It was nonetheless pointed out that years of schooling does not capture educational achievement since it takes differential efforts to learn different languages. Furthermore, it is difficult to acquire reliable data across countries on years of schooling and it changes slowly over the years. That is why in HDR 1994, mean years of schooling was replaced by 'combined school enrolment'.

In the first HDR 1990, the economic dimension was included by using the logarithm of income up to a ceiling and giving a zero weight to incomes above that. In later years, a different approach was followed. The modified approach allows for diminishing marginal utility of income. However, above that level, a progressive correction factor was introduced to take into account diminishing marginal utility of income through a modified Atkinson formula. The formula incorporates the elasticity of the marginal utility of income with respect to income, which discounts income progressively at higher levels. A subsequent adaptation is that the full range of income is divided into multiples of the poverty line. Thus, for per capita income between the poverty line and twice the poverty level, the Atkinson parameter was taken to be one-half; for per capita income between two and three times the poverty line, the elasticity was taken to be two-thirds and so on. The higher the income relative to the poverty line, the more sharply the additional income gets discounted. Income above the poverty line thus has an effect, but not a full dollar-for-dollar effect. This effect although less at higher levels is enough to differentiate among industrial countries. These modifications have been criticised on the following grounds.

- It is more complicated than a simple logarithmic transformation.
- It is based on a indicator elasticity function rather than constant elasticity.
- It also reduces the weight of extra income above poverty just as severely as the logarithmic transformation does (Trabold-Nubler, 1991).

It has never been suggested that income needs to be supplemented or replaced by another indicator. It has, nonetheless been argued that, conceptually, income overlaps with the other two indicators. Empirically, these indicators are so highly correlated with income that these become almost redundant. However, no change has been incorporated in the HDR 1993 partly to avoid inconvenience caused to the users due to frequent revisions.

In the HDR 1994, some changes have been made in the construction of HDI. First, maximum and minimum values have been fixed for all the indicators. Second, the indicator — mean years of schooling — has been replaced by the combined primary, secondary and tertiary enrolment ratios, as noted above. Third, the minimum value of income has been revised from PPP $200 to PPP $100. This revision became necessary because in the construction of the gender-related index, the minimum observed value of female income of PPP $100 was to be used as the lower limit. Importantly, the HDR 1994 introduced a new concept of human security — the security of people in their homes, in their jobs, in their communities and in their environments. It identified the policy changes in national and global management, required in keeping with this new concept of human security.

The HDR 1995 considers the HDI to be providing a partial snapshot of human development and therefore has limitations as a comprehensive measure of human development. To give a more complete picture, the HDI should be supplemented with other human indicators and particularly those pertaining to political freedom, environmental sustainability and equity. The basis for the selection of such critical dimensions should be linked to basic capabilities which people must have to participate in and contribute to the society. The concept of human development has, thus, gone beyond its basic premises and presently seeks to cover sustainability of development process. Human development is, thus, being viewed as a process of enlarging people's choices so that they can decide ways and means to achieve material well-being within the context of their socio-political and economic systems. Such enhancement must be for both present and future generations without sacrificing one for the other. Human development, thus, not only puts people at the centre of development but also advocates protecting the life opportunities of future generations and respecting the natural systems on which all life depends.

Another aspect of the concept is equity of opportunity and standard of living among all sections of the population. All barriers to economic and political opportunities must be eliminated so that people can participate in and benefit from these opportunities. Sustainable human development addresses the issue of equity both within a generation as also between generations. It seeks to limit development process within the carrying capacity of nature, giving high priority to environmental regeneration and protection of opportunities for future generations. Another area of concern is creation of 'enabling environment' so that the potentials of individuals can be optimally utilised. This is compatible with the modern day economic thinking of globalisation, cross border co-operation and scientific temper. HDR 1995 also states that the most essential component of human development paradigm is *'empowerment'* of the people.

The HDR 1996 admits that there is no automatic link between economic growth and human development, but when these links are forged with policy and determination, they can be mutually reinforcing and economic growth can effectively improve human development.

In HDR 1999, a thorough review of the treatment of income in the HDI was done, based on the work of Anand and Sen (1999). Earlier, the average world income was taken as the ceiling and any income above this level was discounted using Atkinson's formula for the utility of income. The main problem with this formula is that it discounts the income above the threshold level heavily. The new methodology adopted to construct the index of income discounts all income and not just the income above a certain level. Further, the middle-income countries are not penalised heavily as their relative values rise because of the new discounting formula.

3. CONCEPTUAL ISSUES OF SCALING AND ASSIGNING WEIGHTAGES

The models and techniques for constructing a composite index of development should emerge from the objectives of the study and the analytical frame within which the issue of indexing has been conceptualised. This is so because it is not possible to apprehend or assess development independent of a theoretical frame.[1] The justification of the assumptions — technological or behavioural, that any model makes, must be sought in the underlying theory, which, in some way, is an abstraction of the real empirical situation.

The crucial stage in measuring development within a multivariate framework is that of contracting a large number of indicators into a smaller number of indices so that the geographical (micro) units such as regions, districts villages, etc. can be easily compared with each other.

3.1 Measuring Development and the Theory of Collective Choice

It may be somewhat surprising that, although economic aspects constitute a major dimension in any exercise at measuring development, the contribution by economists in developing a methodology, has, at best, been marginal. It is unfortunate that within the theoretical constructs of traditional economics, it is generally not possible to say whether region A is more or less developed than region B, when development is defined in terms of more than one indicator. Of late, a new generation of economists is showing keen interest in the subject and attempting to rank countries and regions based on a large number of parameters. The efforts of UNDP to build composite indices for a large number of countries also fall in this category. No attempts have, however, been made to integrate these isolated attempts with the established economic thinking.

It has been mentioned above that measuring development involves construction of composite indices. The latter, in most cases, are taken as real valued functions of the constituent indicators, although these could be orderings as well. The indicators relate to various socio-economic dimensions of the phenomenon under investigation and are generally measured in a ratio scale. These could, however, be judgements of individuals expressed in an ordinal scale, over a set of districts and in such a case, compositing would imply working out an aggregative

[1] Coddington (1972)

social ordering based on individual orderings. The major concern of the theory of collective choice, a fairly developed branch of economic analysis, happens to be almost identical to this. It addresses itself to the problems of constructing community preference functions based on the preferences of individual members of the community.[2] For a student of economic theory venturing into the area of regionalisation, it is legitimate to ask how much guidance he might seek from the theory of collective choice and also to explore the possibilities of considering regionalisation as a problem in welfare economics.

It is unfortunate that one cannot travel a long way within the premises of the theory of collective choice in working out a complete regionalisation scheme. The celebrated 'Pareto Criterion' would prove to be severely restrictive in an exercise in regionalisation because of its inherent 'incompleteness'. If Uttar Pradesh happens to have an edge over Haryana in one dimension of economic development and lags far behind in respect of all others, Pareto criterion would make it impossible to rank Uttar Pradesh above Haryana in terms of their levels of development.[3] The degree of incompleteness would, however, depend on the correlations among the chosen indicators. It is only in an extreme situation, when every district has identical rank position for each indicator, that the principle of Pareto Optimality (weak) would give a complete ordering of districts.

A rational and systematic way of measuring development is to define a real valued function over the relevant values of the chosen indicators that would permit at least an ordering of the districts. The concept of social welfare function suggested by Bergson (1938) and latter developed by Samuelson (1947) appeared to make headway in this direction.[4] However, subsequent developments in the area, specially the much celebrated General Possibility Theorem,[5] proved to be a stumbling block, as four innocuous-looking conditions knocked out all

[2] Arrow (1963).

[3] See Pareto (1927). The criterion does not seem to be very helpful in regional studies since it stops one from making even the `most obvious' judgements.

[4] Bergson considered it possible to establish an ordering of social states based on the indifference maps of individuals.

[5] The theorem was first proposed by Arrow in 1950. This, however had a small error which was subsequently corrected by Blau (1957).

possible functions. In the regional context, the conditions may be stated as follows.

- The condition of weak Pareto rule demands that, when a state has values of indicators uniformly higher than those of another, the former should have a higher position in the composite scale.
- The condition of non-dictatorship implies that no single indicator should be considered to be so important as to determine the final ordering, all by itself.
- The condition of unrestricted domain implies that the method should be capable of giving the final ranking for all possible data matrices. It, thus, rules out a decision criterion that is useful only when a specific data configuration occurs. For example, a decision rule capable of ranking the districts if and only if the relevant indicators are perfectly and positively correlated must be left out of our consideration.
- The final condition is that of independence from irrelevant alternatives which demands that, while ranking two states, the decision must be guided by the values of the indicators for these units alone and not by any other irrelevant phenomenon. For example, the relative levels of development of Uttar Pradesh vis à vis Haryana should not influenced by that of India vis à vis Bangladesh or Kazakhstan vis à vis Puerto Rico.

In case the regional planners consider the four axioms as reasonable, attempts at regionalisation or at ranking the districts or states in terms of their levels of development, etc. would amount to mere quantitative jugglery. The theorem is complete in its nihilism and knocks out all methods designed to produce a composite ranking, respecting all the four conditions simultaneously. It is, therefore, necessary that scholars attempting regionalisation should stop and examine the nature and the value implications of the task in hand.

The only logical way of saving the efforts at measuring development from being dubbed as 'perversion of abstracted empiricism', is to examine the relevance of the proposed axioms. It should be possible to disapprove of at least three of these conditions in the regional context. First, it can be argued that, when a concept is basically incomplete, a method should have the option of not ranking certain pairs of districts if some specific data configuration occurs. When Karnataka is more developed in agriculture than Andhra Pradesh by a small margin and in case of industries the case is just the reverse, a regional analyst might prefer to reserve his judgement regarding their relative levels of development. Second, the condition of independence from irrelevant alternatives appears to be too rigid. In view of the present underdeveloped state of regional science, it appears reasonable that the scheme of weightage and composition would depend on the empirical results obtained through the analysis of the data in hand. If the level of agricultural development, for example, becomes fourfold in all the states and regions except in Uttar Pradesh and Haryana, one can understand a change in the relative significance of agriculture in defining the concept of economic development and hence in the relative position of Uttar Pradesh *vis à vis* Haryana. It is also worth keeping in mind that the indicators selected in operationalising a concept are never exhaustive and our assessment of the social reality would be different when more indicators are included in the analysis. Certain development in the economy might change the socio-economic position of two states but that may not be captured through the chosen indicators. When these developments can be captured by analysing the overall changes in the data configuration, the latter must not be considered as irrelevant. It is, thus, possible to argue for a change in the ranking of Uttar Pradesh vis à vis Karnataka over a period of time even when their values for the selected indicators remain unaltered. Lastly, there are scholars who consider the 'dictatorial' attitude in regionalisation exercises appropriate. They take a single indicator, for example, per capita income, value of output, etc. for the final ranking of the districts, although the significance of other indicators is not formally denied in their measurement schemes.

3.2 Eliminating Scale Bias in an Exercise of Composition

The composition of indicators can be done in two stages (a) elimination of the bias of scale and (b) determination of weightages. These are discussed separately while highlighting the elements of subjectivity embodied in the various methods employed in each stage.

3.3 Making the Indicators Scale Free

The indicators chosen for working out composite indices are measured in different units and hence in general are not directly additive. It, therefore, becomes necessary to convert them to some standard 'units' so that the initial scale chosen for measuring the indicators do not bias the results.[6] It is, however, true that any method of scale conversion involves implicit weighting and the selection of a standard scale is never a value free decision.

Conversion to a Discrete Scale: For eliminating the bias of scale, the chosen indicators can be transformed into discrete indicators. Each observation may be assigned a value in the discrete scale on the basis of its relative position in the series. The method of ranking, popular among regional scientists for its simplicity and computational ease, falls in this category.[7] This method

[6] Anderson (1958) raises this problem in connection with the application of factor analysis to identify the basic factors for a given data matrix. Also see Kundu (1975).

[7] See Kendall (1939). He uses rank values to construct composite indices (which he calls ranking coefficients) in his attempt to regionalise England on the basis of crop productivity.

has been dubbed as having 'doubtful theoretical meaning', as unit difference in ranks do not reflect an equal difference in indicator values.

***Range Equalisation Method**:* The distribution for each indicator can be adjusted in such a manner that each would have the range from zero to 100. This can be achieved by simply subtracting the lowest value from each indicator, dividing it by range and then multiplying by 100. The first scholar to use the method in Indian context was Schwartzberg (1969) for the purpose of socio-economic regionalisation based on a composite index.

Standardisation: The scale-effect can be removed by dividing the deviation of each observation from the mean by the standard deviation. This technique, widely used by Western geographers, imposes such conditions on indicators which might be sufficient, but not necessary, to eliminate the bias of scale. Subtraction of the mean from each observation distorts the 'relative position' of the observations. Addition (or subtraction) of a value to (from) two unequal observations affects their earlier 'relationship', whereas division or multiplication by any positive (finite) number leaves it unaffected when the indicators are measured in a ratio scale. The method also has the disadvantage of equalising variance and length of all the indicators and this may be taken as discrimination against indicators having higher dispersion, independent of scale.

Division by standard deviation: The observed values of an indicator may be divided by the standard deviation of the series, which is an absolute measure of dispersion, to obtain a new series with standard deviation as unity.[8] This method does not lead to a shift in the origin, although the criticism levelled against the method of standardisation for equalising variance would be valid in this case also.

Division by mean: The observations for each indicator can be divided by the mean to get rid of the bias of scale without affecting the relative position of the districts in the series. This transformation does not disturb the 'dispersion' of the indicators since the co-efficient of variation (CV) of the original series is retained as the standard deviation (or the CV) of the transformed series. In social research, however, mean does not enjoy any 'secular sanction' greater than any other parameter of the distribution nor is there a priori justification for preserving the CV of the original series as standard deviation of the new series.

[8] See Rao (1972).

Division by an 'ideal' value: A value higher or lower than the mean, viz. national or international average, target parameter, etc. may be considered to be the norm of a series. It should then be possible to suitably manipulate the CV by dividing the series by this normative value. When norm is higher (lower) than the mean, the standard deviation of the transformed series will be less (more) than the CV in the original series. This is understandable because a given difference put in relation to two unequal values has a different significance.

3.4 Assigning Weightages 'Objectively'

Once the bias of unit of measurement is removed from the observations, the crucial problem that remains is of assigning appropriate weightages to the chosen indicators. If a researcher has sufficient insight into the nature and magnitude of the interrelations among the indicators and their socio-economic implications, he or she might choose to determine the weightages using individual judgement. This often introduces a certain amount of subjectivity into the analysis, although in some situations it might help in capturing the social reality much better than any statistical technique. Regional patterns obtained through such methods, however, stand exposed to ad hoc influences of vested interests. A research agency can, for example, obtain a ranking of the districts to suit the interests of the organisation it is serving by manipulating the system of weights. In a democratic set up, where the fate of policy-makers depends, largely, on the support of various pressure groups, ambiguity regarding the scheme of weightages would be helpful in following a policy of appeasement and may result in decisions injurious to the less privileged regions.

Determination of the weights for the indicators in a positivistic manner is, as has been mentioned above, a wild goose chase. One can only hope to minimise the dangers of ad hoc political influences, group pressures and opportunistic errors by applying standard mathematical techniques whose value implications are well known to the users and to other concerned parties.

***Equal Weightages*:** Giving equal weights (also called the method of unweighted aggregation) is one of the popular axioms proposed to solve the weightage problem. Giving equal importance to all the indicators is often considered to be an acceptable solution when there is no reason to do otherwise.[9] Arguably, giving equal importance to all indicators is not necessarily the best answer, especially when the composite index is likely to be used for policy purposes. Even when the principle to give 'equal importance' to the indicators is accepted, it may be interpreted to mean equal correlation with the composite index or equal representation in the variance of the composite index.

3.5 Principal Component Analysis of the Correlation Matrix

Principal component analysis (PCA) enables one to determine a vector known as the first principal component/factor — linearly dependent on the constituent indicators, having the maximum sum of squared correlations with the indicators. The eigen vector f corresponding to the maximum eigen value of the correlation matrix R, gives the required factor loadings (weights). The composite index for the ith geographical unit Y_i may be obtained by linearly combining the standardised indicator values X_{ij} (j = 1,.......,m), the weight for the jth indicator being the jth element in the vector f. ($f_1, f_2, \ldots, f_m$).

$$Y_i = X_{i1}.f_1 + X_{i2}.f_2 + X_{i3}.f_3 + \ldots + X_{im}.f_m$$

There would be, except in cases of linear dependency, *m* such principal components orthogonal to each other. It can be shown that when the eigen vector f is normalised to the corresponding eigen value, its elements would give the correlation of the principal component Y ($Y_1, Y_2, \ldots, Y_n$) with the constituent indicators. The single but most significantly correlated component can now be taken as a proxy for development.[10] When more than one principal component is made use of , each is associated with a group of selected indicators based on the weightages the factor assigns to the indicators. Even without such interpretation of the factors, the effectiveness of the principal component analysis in summarising the variations of a large number of indicators into a smaller number of orthogonal components has been widely commended and found useful in regional studies. A set of principal factors, that jointly explain a reasonable proportion of variation in the data matrix, can be collectively used for regionalisation without assigning any 'meaning' to each. Regionalisation based on a unique index obtained by

[9] Kendall (1939) delineates crop productivity regions of England by aggregating the scale free scores (rank values) by giving them equal weights.

[10] The factor analysis model came into existence with the "two factor theory" of Spearman which considered only one common factor. A shift in the emphasis occurred during 1930–50. An important work in this period was that of Thurstone (1947) who stressed the need for considering more than one factor.

compositing a set of principal factors should, however, be avoided as the index would not have the optimality property of the factors.

The first principal factor characterised by the property of having the largest sum of squared correlations (or the maximum variance when the weights are normalised to unity) is generally obtained by post multiplying the column vector f_1 to the standardised data matrix as has been indicated above. However, in view of the limitations of the method of standardisation, discussed above, the indicators may be made scale free by dividing each by its standard deviation.

An alternative approach in the application of principal component analysis is to divide the selected indicators into sub-groups in such a way that, within a sub-group, "they have intercorrelation, while canonical correlation between pairs of sub-groups is low on an average".[11] The principal component analysis can then be applied to each sub-group of indicators. The first principal factors obtained from different sub-groups may be treated as a set of new indicators and may be composited at the second stage to obtain the final composite index. It has been argued, that this method alleviates the necessity of taking more than one principal factor, since the correlations among the indicators in a sub-group are generally high and consequently, the first principal factor explains an 'adequate' proportion of the variation in the data matrix. The economic logic for the formation of such sub-groups based on correlation, however, has seldom been discussed in the available literature.

Principal component analysis and its variants are held in high esteem by development analysts because of their optimality properties. Whenever strong interrelation among indicators is encountered, it is safe to recommend this method. One also reads that the method "takes care of multicollinearity"[12] without being fully informed regarding the implications of such a proposition. Importantly, the weights in the first principal factor are directly dependent on the correlations, that is higher the correlations of an indicator, the greater is its weight. It is needless to mention that there is no a priori justification` for accepting this principle for constructing a composite index for regionalisation.

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[11] Pal (1972)

[12] Dasgupta (1971)

4. AN AXIOMATIC FRAMEWORK FOR WORKING OUT HDI

It can be demonstrated that all statistical methods, including those for eliminating the scale bias or assigning weightages, call for value judgements. A search for 'objectivity' in the tools in social research would be futile if the term is understood as total neutrality to values or assumptions. Instead, one can look for methods that incorporate "explicit bias that are genrally acceptable" or assumptions of which can be tested empirically. An axiomatic approach to measuring human development — the approach which is followed here — would make the normative elements underlying the quantitative techniques transparent. It would also enable researchers to carry the task of making value judgements to a higher level — a level at which discussion on values is possible. This approach has an operational advantage for the obvious reason that it is simpler to obtain consensus on general principles than on a specific method of removing scale bias and assigning weightages, in working out an aggregative index.

4.1 Methods, Axioms and Social Reality

The following axioms may now be proposed for eliminating the bias of scale.

Axiom R: Maintenance of Relativity

The scale transformation must not alter relative ranking of the observational units. Since most of the indicators used in regionalisation are measured on a ratio scale[13] this axiom should not be very demanding.[14]

Axiom S: Comparability and Standardisation

The mean of all the transformed indicators must be equal. The axiom thus proposes a scheme for standardising the average values. It ensures that an indicator does not make a bigger contribution to the composite index just because it happens to be measured in smaller units and as a result, has a larger average value.

[13] Sen (1973) gives a brief but neat presentation of different scales of measurement.

[14] It can be argued that some of the chosen indicators relate negatively with the underlying concept and hence an inverse scale conversion, that is making the values negative, taking reciprocals, reversing the ordering, etc. may become necessary. We consider such transformations to be inappropriate at this stage since each Xi, here, has been taken to be a positive indicator of the underlying concept.

It is unfortunate that most methods of scale conversion currently used in the development literature, fail to satisfy these two axioms. The method of ranking and standardisation, for example, violates Axiom R, while the method of division by range (UNDP method) or standard deviation violates Axiom S. The only method, discussed here, which satisfies the axioms is that of division by the mean. In fact, division by any value other than the arithmetic mean violates Axiom S.

Following the schema on scaling of indicators, a set of axioms can be proposed for judging the relevance of the methods for giving weightages. It is, however, more difficult to obtain unanimity on a specific axiomatic structure. It is only through substantial empirical research on the processes of socio-economic development, that an appropriate set of axioms can be determined. In view of the existing theories of regional development and the available empirical literature the following axioms may be suggested.

Axiom C

(a) An indicator having stronger interrelations with the other indicators should have higher weight.

It has been maintained in the current regional studies that the developmental indicators tend to be highly correlated[15] in space. This is also substantiated by the empirical analyses in different parts of the world.

(a^{-1}) Indicators that have weaker correlations must have higher weightages.

It is possible to argue that the correlations indicate the significance of the indicators only in a negative sense. When the selected indicators depict the various manifestations of a single underlying process, the intercorrelation among them may be understood as indicating the magnitude of the errors of duplication. In such situations, one has reasons to give lower weight-ages to the highly correlated indicators.

[15] Rao (1973) argues that one can "start with the supposition that the degree of development of a region is expressed in certain interrelated features".

Axiom D

(b) An indicator having greater disparity in space must have a higher weight.

In an economy where the market mechanism dictates the path of development, the core industrial sectors and the important socio-economic services would get concentrated in a few centres. One can, therefore, choose to assign weights on the strength of the disparity in the distribution of the indicators.

(b^{-1}) Indicators with greater dispersion in space should be given relatively smaller weights.

The converse axiom (b^{-1}) suggests that the ubiquitous indicators play a more important role. This would, however, have limited validity in the context of regional economic development.

Acceptance of the above axioms in a given context, individually or in pairs (one from Axiom C and the other from Axiom D) would help in the selection of the method for determining weightages. Following Axiom C(a) one can give weights to an indicator proportional to the sum of its correlations.[16] The first principal component obtained on the basis of correlation matrix is also appropriate in this context. **Importantly, this is the most popular method used by development analysts in articulating the levels of development.** Ranking of the indicators on the basis of the weights obtained through these two methods would, generally be very similar.

In situations where Axiom D(b) is considered to be relevant, indicators may be assigned weights directly proportional to the CV.[17] If both the Axioms C (a) and D (b) seem to be valid in certain context, there is a case for considering the principal component maximising the sum of squared projections of the indicators made scale free through division by mean. Indeed, this has been considered appropriate in the context of indexing human development at the state level in India, as discussed in Section 5. Alternatively, if Axiom D (b^{-1}) is taken as being more appropriate, principal component analysis can be applied to the variance-covariance matrix after replacing its diagonal elements by the reciprocal of the variance (Kundu, 1980).

[16] UNRISD (1970) followed this procedure in measuring the socio-economic distances among various countries.

[17] See Kundu and Sharma (1976).

Duplication of indicators in terms of a cause and effect relationship calls for Axiom C(a^{-1}) and here one may propose to obtain the weights through the equal correlation method. If, in addition, disparity is required to play a role in designing the weight structure, one can recommend the method of unequal correlations. The correlation of the composite index may, then, be directly or inversely proportional to the CV of the indicators, depending on the relevance of the Axiom D (b) or D (b^{-1}) in the given context.

Axiom N

No indicator should have a negative weight in the composite index.

It seems reasonable that, once a set of indicators has been selected on the strength of an analytical framework and proper empirical investigation, none should get eliminated or be assigned a negative weight owing to the technicality or the method. This, however, does not preclude the possibility of a negative indicator entering the analysis. The axiom merely suggests that such indicators should be suitably transformed so that they have positive associations with the overall composite index.

The innocuous looking Axiom N has a serious restrictive property. Most of the methods discussed above fail to ensure non-negativity of weights unless a certain restriction is imposed on the data configuration. When the data matrix is non-negative, which is often the case in social science research, the method of maximising the sum of squared projections of the indicators (using principal component analysis on the projection matrix) would give non-negative weights.[18] This is, however, not guaranteed if the traditional principal component analysis (applied on the correlation matrix) is used to work out the first principal component, to be used as a composite index of development. Indeed, the other factor analytic methods give non-negative weights only when the correlation or the variance-covariance matrix satisfies certain additional constraints. It may however, be pointed out that the principal component analysis on

[18] In traditional PCA, weightages are obtained from the eigen vector associated with the largest eigen value of the correlation matrix (R), as mentioned in the text above. R in turn is obtained as R = X'X/n, where X is the standardised data matrix and n is the number of observations. In the modified approach, the projection matrix (A) is obtained as A = X*'X*/n where X* is the scale free data matrix obtained by dividing each column by original data matrix.

the correlation matrix has been extremely popular in constructing composite indices and articulating multi-dimensional concepts.

4.2 Techniques Selected for the Present Study

In this study, the first set of composite indices has been built up by using the methodology adopted by UNDP in computing the Human Development Index, on the chosen indicators. To elaborate, each indicator has been divided by its range (maximum value – minimum value) and then aggregated without giving any weight. It may, however, be pointed out that this range equalisation method, violates Axiom S. There is no justification for forcing all the indicators to have identical disparity. Even if for some considerations of international policy, the three components are required to have equal variability, there is still no justification for taking range as the measure of disparity.

It is well known that range depends only on two extreme values in a distribution. Making the aggregative index sensitive to extreme values brings in instability in the methodology, which can easily be avoided. Further, keeping the range for each indicator from zero to hundred is convenient for computational purposes but this results in loss of additional information. Subtraction of the lowest value from the entire series disturbs the earlier relationships between observations. This would be a significant loss if the indicator is measured in a ratio scale since the ratio of two observations before and after the scale transformation would not be the same.

Keeping in view these limitations, this study has adopted an innovative technique. Each of the selected indicators has been divided by the mean of the series. This makes it possible for the indicators to maintain their intrinsic disparity. The standard deviation of the new series (obtained by dividing the indicator by mean) would be equal to the CV of the original series. The three indicators thus retain their CV as standard deviation at the stage of composition. This implies that the indicator having larger CV would implicitly get a higher weight.

The second set of indices has thus been obtained by making the indicators scale free through the method mentioned above which results in minimum loss of information. It has been considered proper to use 'division by mean' method in this exercise, as the selected indicators have significant differences in their degree of variability. These alternate composite indices have been computed by adding the indicators after making them scale free through division by mean. As a consequence, the indicators that have high CV would automatically contribute more than the others in the aggregate index.

A third set of composite indices has been built by giving explicit weightages to the sale free indicators. For giving explicit weights, discussion of the Axioms C and D and their relevance in the Indian context would be extremely important. It would possibly be easier to agree upon the axiom of correlations — the indicators having higher correlations with other selected indicators may have higher weightages. This can be defended on the ground that the correlated indicators would be more effective if used as the basis for policy intervention since these can bring about substantial changes by affecting the system through all its interrelated indicators. Most of the regional analysts, using quantitative methods for composition, have also found the method acceptable.

It may not be desirable to ignore the aspect of disparity in designing a system of weightages. In Indian context wherein growth dynamics have operated through a few large cities, the manifestations of growth would reflect high disparity. As a consequence, the important growth indicators generally exhibit high disparity in space. This gives rationale for Axiom D implying that the indicators with higher CV may be given higher weights.

Accepting the validity of both the Axioms C(a) and D(a), the principal component analysis has been applied on the projection matrix to obtain the weights in this study. This method is axiomatically different from the traditional PCA since it rejects the correlation matrix as the basis for working out factor loadings or weights. Instead, these loadings are computed in a manner such that, besides the correlations, disparities in distribution, too, have their say. The weighting scheme is such that, other things remaining the same, the indicators with higher CV would get higher weights. Finally, it satisfies the non-negativity axiom (N) since the socio-economic data matrix is generally positive and it would remain so even after the division by mean. Consequently, the projection matrix, computed from the scale free data matrix, would give factor loadings (eigen vector) as positive. This is not so in case of traditional PCA since the correlation matrix, used in computing the factor loadings can have negative entries.

5. CONSTRUCTING HDI FOR INDIAN STATES

Effective targeting of development programmes initiated by the government often requires knowledge regarding the position of each state in terms of human development. An attempt is made here to compute human development index (HDI) in the major states in India using alternate methods of scaling and composition and examine the regional variation. A composite HDI would enable determining the levels of development of the states and rank them in an ordinal scale. Understandably, it does not suggest what goals, priorities and development strategies a country/state should pursue in order to improve the human development status. The method of composition, on the other hand, makes a number of assumptions and these need to be defended in terms of the goals and objectives of development pursued by the country. The methods of indexing human development, therefore, can not be independent of the framework of the research study.

One crucial question that arises in this context is whether the social database in the country is adequate for the preparation of Human Development Profile or Human Development Index at the state level, similar to what is done in the UNDP reports? Relevant data are available from sources like the Census, NSSO, SRS, NCERT, NFHS. These offer fairly dependable information that could be used to prepare a HDI that can address a broad range of national concerns. However, following are some limitations of the existing data sources.

- All sources do not have uniform concept coverage or a framework.
- The indicators on which different sources collect information are different.
- The time period and the periodicity of data collection are different for different sources.

Because of these limitations, effective targeting of programmes and policies through a composite index or identification of the causal factors responsible for the disparities becomes extremely difficult.

National Council of Applied Economic Research (NCAER) in 1993–94 initiated a major research project on Human Development on behalf of the Planning Commission, with the financial support from UNDP, UNICEF, UNFPA and IDRC. The objective was to construct a human development profile for major states in the country through data available from secondary sources and also primary survey. The NCAER–HDI sample survey – 1994, covered 33,200 rural households spread over 1765 villages in 195 districts of 15 major states and the North-eastern region. The data generated through the survey enabled NCAER to construct about 100 indicators of progress in four broad areas of social concern, viz. material well-being, health, education and basic amenities. The NCAER data are, therefore, useful in building HDI highlighting the inter-state differences in different aspects of social well-being. This would be essential for effective design and implementation of many social sector programmes.

For computing the HDI of Indian states in this study, 41 indicators in four broad areas of social concern, viz. economic development, health, education and basic amenities have been chosen. Most of the data have been taken from the National Council of Applied Economic Research (NCAER) survey conducted during 1993–94. A few have been built using other official sources, as indicated at the bottom of the tables. The analysis based on the correlations among different indicators suggests that NCAER data have a high degree of consistency and would be useful in determining the rank order of the states. For example, the NSSO and Census data reveals that there is negative correlation between percentage households having pucca houses and those having toilets facilities, defying a common sense explanation. The NCAER data, however, are noted as not exhibiting such patterns which cannot be explained through commonplace logic.

5.1 Indicators of Economic Development

In the area of economic development, five output and four input indicators have been taken. The five output indicators are productivity of agricultural workers (in value terms), yield of food grains per hectare, State Domestic Product per capita, consumption expenditure per capita and percentage of people above the poverty line. The four input indicators are adult literacy rate, net irrigated area as percentage to net sown area, fertiliser consumption (kg/ha) and power consumption (kWh/000 ha) in agriculture. The output and input indicators have been analysed separately. The final index of economic development has been obtained by adding the aggregative indices of output and input, as shown in Table I.

TABLE 1
Index of Economic Development by Alternate Methods

States/ Region	Div. By Mean	UNDP	PCA
Andhra Pradesh	1.22**(4)**	0.54**(4)**	1.24**(4)**
Bihar	0.78**(11)**	0.16**(13)**	0.77**(11)**
Gujarat	1.08**(5)**	0.42**(6)**	1.09**(5)**
Haryana	1.52**(2)**	0.75**(2)**	1.54**(2)**
Himachal Pradesh	0.73**(13)**	0.19**(12)**	0.71**(13)**
Karnataka	0.94**(8)**	0.31**(8)**	0.99**(8)**
Kerala	1.01**(7)**	0.47**(5)**	0.99**(7)**
Madhya Pradesh	0.71**(15)**	0.11**(15)**	0.71**(14)**
Maharashtra	0.86**(10)**	0.28**(9)**	0.86**(9)**
North-eastern Rg.	0.71**(14)**	0.21**(11)**	0.68**(15)**
Orissa	0.62**(16)**	0.02**(16)**	0.60**(16)**
Punjab	1.87**(1)**	1.00**(1)**	1.91**(1)**
Rajasthan	0.74**(12)**	0.15**(14)**	0.74**(12)**
Tamil Nadu	1.27**(3)**	0.56**(3)**	1.29**(3)**
Uttar Pradesh	1.07**(6)**	0.38**(7)**	1.08**(6)**
West Bengal	0.87**(9)**	0.22**(10)**	0.86**(10)**

Note: Figures in parenthesis denote ranking of the states.

Table 1 reveals that irrespective of the methodology used in computing the HDI, the states of Bihar, Rajasthan, Madhya Pradesh, Orissa along with Himachal Pradesh and North-eastern region occupy low ranks in the development ladder. Punjab, Haryana, Tamil Nadu and Andhra Pradesh, on the other hand, appear at the top. Surprisingly the states of Maharashtra and Karnataka are lagging behind in a few cases, coming even behind Uttar Pradesh. This may be due to two reasons. Firstly, the yield of food grains in Uttar Pradesh is more than twice than that of Maharashtra and 1.5 times greater than Karnataka. Secondly, the net irrigated area as a percentage to the net sown area in Uttar Pradesh is four and half times that of those two states. It appears that these two indices dominate the over all development scene.

5.2 Indicators of Educational Development

For computing an index of educational development, four output indicators and three input indicators have been taken into consideration. All the data except that on public expenditure on elementary education and percentage NSDP spent on total education (taken from Ministry of Human Resource Development, Department of Education, Government of India) have been taken from NCAER–HDI survey, 1993–94. Computations have been done separately according to output and input characteristics. The final index has, however, been obtained by aggregating the output and input indices.

TABLE 2
Index of Educational Development by Alternate Methods

States/ Region	Div. By Mean	UNDP	PCA
Andhra Pradesh	0.75**(15)**	0.14**(15)**	0.75**(15)**
Bihar	0.92**(7)**	0.37**(7)**	0.93**(7)**
Gujarat	0.88**(9)**	0.24**(9)**	0.88**(9)**
Haryana	1.15**(4)**	0.58**(4)**	1.16**(4)**
Himachal Pradesh	1.53**(2)**	0.87**(2)**	1.53**(2)**
Karnataka	0.91**(8)**	0.27**(8)**	0.91**(8)**
Kerala	1.69**(1)**	0.94**(1)**	1.69**(1)**
Madhya Pradesh	0.68**(16)**	0.02**(16)**	0.68**(16)**
Maharashtra	0.87**(10)**	0.13**(10)**	0.87**(10)**
North-eastern Rg.	1.26**(3)**	0.57**(3)**	1.26**(3)**
Orissa	0.84**(11)**	0.17**(11)**	0.84**(11)**
Punjab	1.11**(5)**	0.53**(5)**	1.12**(5)**
Rajasthan	0.83**(12)**	0.18**(12)**	0.83**(12)**
Tamil Nadu	1.00**(6)**	0.32**(6)**	1.00**(6)**
Uttar Pradesh	0.79**(14)**	0.17**(14)**	0.79**(14)**
West Bengal	0.79**(13)**	0.09**(13)**	0.79**(13)**

Note: Figures in parenthesis denote ranking of the states.

It is clear from Table 2 that Kerala, Himachal Pradesh, North-eastern region and Haryana occupy the first four positions in terms of educational development and Madhya Pradesh, Andhra Pradesh, Uttar Pradesh and West Bengal occupy the lowest positions by all the three methodologies. It is surprising that the state of Bihar emerges as educationally developed and it has values higher than that of Maharashtra, Karnataka, Gujarat and Andhra Pradesh. This is true irrespective of the methodology used. This finding, however, may not be conclusive as it raises more questions than it answers. Importantly, if we take only the output indicators which is a combination of stock, flow and past performance, we see that Bihar is lagging behind Maharashtra, Gujarat and Karnataka which is understandable. Bihar spends 5.1 per cent of SDP on education, which is the highest among all the states. Since the state domestic product is very low (lowest among the states), even a small expenditure gives a high proportion of the income spent on education.

5.3 Indicators of Health Development

In this area, eight positive indicators and six negative indicators have been taken into consideration to compute the aggregative index (Table A.3). Except the data on life expectancy at birth (taken from Census, Government of India), all other data have been taken from NCAER–HDI survey, 1993–94. The composition has been done separately for positive and negative indicators. As we are considering only the positive dimensions of development, the composite index for the negative indicators has been transformed by taking the reciprocals. To obtain the final index, these reciprocal values have been added to the aggregative value of positive indicators. The over all composite index for the 15 Indian states and North-eastern region is presented in Table3.

TABLE 3
Index of Health by Alternate Methods

States/ Region	Div. By Mean	UNDP	PCA
Andhra Pradesh	1.12**(6)**	0.58**(6)**	1.12**(6)**
Bihar	0.75**(15)**	0.14**(13)**	0.75**(15)**
Gujarat	1.16**(4)**	0.61**(4)**	1.16**(4)**
Haryana	1.13**(5)**	0.56**(7)**	1.13**(5)**
Himachal Pradesh	1.10**(8)**	0.56**(8)**	1.10**(8)**
Karnataka	1.29**(2)**	0.70**(2)**	1.29**(2)**
Kerala	1.67**(1)**	1.00**(1)**	1.68**(1)**
Madhya Pradesh	0.76**(14)**	0.09**(15)**	0.77**(14)**
Maharashtra	1.12**(7)**	0.58**(5)**	1.12**(7)**
North-eastern Rg.	1.09**(9)**	0.46**(10)**	1.10**(9)**
Orissa	0.82**(11)**	0.22**(11)**	0.82**(11)**
Punjab	1.03**(10)**	0.51**(9)**	1.04**(10)**
Rajasthan	0.72**(16)**	0.01**(16)**	0.72**(16)**
Tamil Nadu	1.19**(3)**	0.61**(3)**	1.20**(3)**
Uttar Pradesh	0.77**(13)**	0.12**(14)**	0.77**(13)**
West Bengal	0.81**(12)**	0.15**(12)**	0.81**(12)**

Note: Figures in parenthesis denote ranking of the states.

It is evident from Table 3 that the state of Kerala along with Karnataka, Tamil Nadu and Gujarat are among the high ranking states in terms of health. Unfortunately, the economically less developed states like Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh occupy low ranks. Surprisingly, Punjab, which is economically one of the developed states in this country carries the 10th rank. The reason behind this could be high short duration morbidity and child mortality. It is also noticed that only 6 per cent villages in rural Punjab report the presence of a health sub-centre which is the lowest among all the states.

5.4 Indicators of Rural Infrastructure and Amenities

In the area of rural infrastructure and social amenities, eleven development indicators have been taken into consideration. Except road per thousand sq. km. (taken from CMIE), all the data are from NCAER–HDI survey, 1993–94. These have been aggregated to obtain the composite index of rural infrastructure and amenities. The index for 15 Indian states and North-eastern region is presented in Table 4.

TABLE 4
Index of Rural Infrastructure and Amenities by Alternate Methods

States/ Region	Div. By Mean	UNDP	PCA
Andhra Pradesh	1.06**(8)**	0.47**(8)**	1.06**(8)**
Bihar	0.47**(16)**	0.00**(16)**	0.46**(16)**
Gujarat	1.12**(7)**	0.51**(6)**	1.12**(6)**
Haryana	1.12**(6)**	0.61**(4)**	1.21**(7)**
Himachal Pradesh	1.16**(5)**	0.56**(5)**	1.16**(5)**
Karnataka	1.02**(9)**	0.44**(9)**	1.01**(9)**
Kerala	1.92**(1)**	1.00**(1)**	1.96**(1)**
Madhya Pradesh	0.69**(12)**	0.18**(12)**	0.68**(12)**
Maharashtra	0.99**(10)**	0.41**(10)**	0.99**(10)**
North-eastern Rg.	1.18**(4)**	0.48**(7)**	1.11**(4)**
Orissa	0.59**(15)**	0.03**(15)**	0.59**(15)**
Punjab	1.27**(3)**	0.67**(2)**	1.34**(3)**
Rajasthan	0.65**(13)**	0.12**(13)**	0.65**(13)**
Tamil Nadu	1.34**(2)**	0.66**(3)**	1.26**(2)**
Uttar Pradesh	0.60**(14)**	0.08**(14)**	0.60**(14)**
West Bengal	0.82**(11)**	0.25**(11)**	0.81**(11)**

Note: Figures in parenthesis denote ranking of the states.

It may be seen from Table 4 that Kerala, Tamil Nadu and Punjab occupy the first three ranks and Rajasthan, Uttar Pradesh, Orissa and Bihar occupy the lowest ranks by all the three methodologies. The states having villages connected by pucca roads showed consistently high literacy and enrolment rates. They also have high child immunisation rates, high contraceptive prevalence, low birth rates, low short duration morbidity and larger number of delivery attended by trained personnel.

It may be observed that the states with better infrastructure facilities tend to have higher levels of economic development. Similarly, availability of protected water has a direct relationship with health indicators. The existence of health sub-centre and *anganwadis* has a significant bearing on health output measures, such as the immunisation, contraceptive prevalence and birth rates. This exhibits negative relationship with the incidence of short duration morbidity and child mortality. Further, the states with high percentage of net irrigated area show higher levels of income and lower levels of poverty although the relationships are not very strong.

A comparative analysis of the aggregative indices presented in Tables 1 to 4 reveals that the relative positions of the states do not undergo major change with alternate methodology of measurement. The positions of the states in the development ladder are not very sensitive to the methodologies of constructing development indices. The co-efficient of variation in the composite index obtained through the UNDP methodology is much more than that of the individual indicators, whereas that for other two methodologies is well within the limits of variations of the indicators and this is true for all the four areas of social concern.

6. CONCLUSIONS AND POLICY IMPLICATIONS

Understanding the levels, pattern and dynamics of development in a country is an important but difficult task. Using this understanding to conceive, formulate and implement development plans and policies is still more difficult. Surprisingly, the planning process in the country almost exclusively depends on the information and data generated through public sources. The social and economic picture of the nation and its various states obtained through this is therefore, limited and sometimes even confusing. It would, therefore, be useful that scholars, academic institutions and independent researchers use alternate data sources and methodology and build up a vision of the country. They should also communicate among themselves as also with policy framers and the planning bodies at regular intervals so that the policy decisions can be based on more informed research.

It is important that despite plethora of studies on human development at the state level, there are only a few studies that assess the levels of human development within a comparative framework. The present study fills in that gap and discusses a few policy implications of the development scenario emerging from the analysis.

State Level HDI Estimates

The studies by Shiva Kumar (1991), Tilak (1991), Pal and Pant (1993) and Srinivasan and Shariff (1996) are a few that have computed the human development index for the Indian states. Table 5 gives the comparative HDIs computed by different authors using the UNDP methodology along with the estimates in the paper by Kundu, Shariff and Ghosh (KSG). Importantly, KSG also includes an index based on UNDP methodology using a different and larger set of indicators.

The following regional scenario emerges through the four composite indices. Andhra Pradesh gets the 7th rank in KSG Index whereas in other three it is ranked 9th or 10th position. The ranking of Himachal Pradesh goes up and down, ranging from 4 to 9. Karnataka gets a fairly even kind of ranking from all the methodologies. Kerala enjoys the first position in all except in the ranking of Pal and Pant where it gets the second rank. The ranking of West Bengal also fluctuates significantly, ranging from 7 to 13. The remaining states get fairly stable ranking by all the methodologies.

TABLE 5
HDI and Ranking of Indian States by Different Authors

States/ Region	Kundu, Shariff & Ghosh (KSG) 2000	Tilak 1991	Shiva Kumar 1991	Srini-vasan & Shariff 1997	Pal & Pant 1993
Andhra Pradesh	0.432(7)	0.361(10)	0.397(9)	0.413(10)	0.589(10)
Bihar	0.168(12)	0.147(15)	0.306(14)	0.341(16)	0.503(15)
Gujarat	0.445(8)	0.566(5)	0.465(8)	0.478(7)	0.678(5)
Haryana	0.625(3)	0.624(4)	0.514(4)	0.505(6)	0.724(3)
Himachal Pradesh	0.545(4)	0.425(9)	-	0.506(5)	-
Karnataka	0.430(9)	0.502(7)	0.475(6)	0.468(8)	0.639(8)
Kerala	0.853(1)	0.775(1)	0.651(1)	0.628(1)	0.769(2)
Madhya Pradesh	0.100(16)	0.196(14)	0.344(13)	0.367(14)	0.543(12)
Maharashtra	0.353(10)	0.655(3)	0.532(3)	0.555(2)	0.711(4)
North-eastern Rg.	0.430(6)	0.256(11)	0.372(10)	0.395(11)	0.608(9)
Orissa	0.110(15)	0.224(13)	0.348(11)	0.373(12)	0.529(14)
Punjab	0.675(2)	0.744(2)	0.586(2)	0.549(3)	0.793(1)
Rajasthan	0.115(14)	0.246(12)	0.347(12)	0.371(13)	0.565(11)
Tamil Nadu	0.538(5)	0.508(6)	0.483(5)	0.511(4)	0.652(6)
Uttar Pradesh	0.188(11)	0.110(16)	0.292(15)	0.355(15)	0.530(13)
West Bengal	0.178(13)	0.436(8)	0.467(7)	0.454(9)	0.641(7)

Note: Figures in parenthesis denote ranking of the states.

A comparison of KSG Index with that computed by Pal and Pant and Tilak reveals that, while for the developed states like Punjab and Kerala, the numerical values of the index do not differ significantly, this is not so for states like Bihar and Uttar Pradesh. By the index of Shiv Kumar and Srinivasan and Shariff, the numerical values are not significantly different both for high ranking as well low ranking states. One point may be mentioned here that all the authors except Pal and Pant and KSG adopted the same indicators chosen by UNDP. Pal and Pant took an additional indicator, that is percentage of people above the poverty line. In contrast, the indicators chosen by KSG in computing the index are different and have a larger canvass. Another thing that should be pointed out is that all the authors, excepting Shiv Kumar, have taken the maximum and minimum values of the indicators from among the Indian states. Shiv Kumar derives these values from a set of about 160 countries in the world.

Based on the above overview, it may be argued that there is a need to institutionalise and strengthen the research on methodology so that the regionalisation and ranking procedures, to a large extent, get standardised and are used in plan formulation, resource allocation, implementation and evaluation of the schemes in an objective manner. Indexing is useful as it highlights the levels of development of geographical units by taking together a number of parameters. The variation in aggregative index and the composite ranking can be explained in terms of the indicators chosen. The present experimentation with alternate methods suggests that no single method can be taken as superior or inferior to others. The choice of particular methods would be dependent on the theoretical framework, which must emerge from the understanding of the process of development in the given region.

It may further be argued that the institutions such as the Planning Commission determining the levels of development of the states or districts, must seek to obtain larger acceptability of their choice of indicators and the methodology of composition. This can be achieved through academic debate on the relevant issues. Establishing certain degree of uniformity in methodology will accord credence to the estimates and help clear the present uncertainty and inconclusiveness in the debate. The attempt of the Planning Commission in standardising the methodology for estimating poverty, needs to be complimented in this context. A similar approach should be followed in indexing human development across states so that the index can be used as a basis for resource allocation and in other areas of policy intervention.

REFERENCES

Anand, Sudhir and Amartya Sen (1999), *The Income Component in the HDI–Alternative Formulations*, Occasional Paper, United Nations Development Programme, Human Development Report Office, New York.

Anderson, T.W. (1958), *An Introduction to Multivariate Statistical Analysis,* John Wiley and Sons, New York.

Arrow, K.J. (1963), *Social Choice and Individual Values,* Yale University Press, New Haven.

Bergson, A. (1938), "A Reformulation of Certain Aspects of Welfare Economics", *Quarterly Journal of Economics*, Vol. 52, February.

Blau, J. M. (1957), "The Existence of Social Welfare Function", *Econometrica*, Vol. 25.

Chattopadhayay, R.N. and M.N. Pal (1972), "Some Comparative Studies on the Construction of Composite Regional Indices", *Indian Journal of Regional Science*, Vol. 4, No. 2.

Coddington, A. (1972), "Positive Economics", *The Canadian Journal of Economics*, Vol. 1, February.

Dasgupta, B. (1971), "Socio-Economic Classification of Districts — A Statistical Approach", *Economic and Political Weekly*, Vol. 6, No. 33.

Dasgupta, Partha (1990), "Well-being and the Extent of its Realisation in Poor Countries", *Economic Journal*, No.100, pp. 1–32.

Kendall, M.G. (1939), "The Geographical Distribution of Crop Productivity in England", *Journal of Royal Statistical Society*, No. 102.

Kundu, A. (1975), "Construction of Indices for Regionalisation", *Geographical Review of India*, Vol. 37, No. 1.

Kundu, A. (1980), *Measurement of Urban Process: A Study in Regionalisation*, Bombay Popular Prakashan, Bombay.

Kundu, A. and A. Sharma (1976), "Dysfunctional Urban Growth, Transportation and Economic Development", *Asian Economic Review*, Vol. XVII, Nos 1, 2 and 3.

Morris, Morris D. and Jmichelle B. McAlpin (1982), *Measuring the Condition of India's Poor — The Physical Quality of Life Index,* Promilla and Company, New Delhi.

Pal, M.N. (1972), "Regional Studies and Research for Consistent Plan Formulation : The Need for a Right Kind of Orientation", *Indian Journal of Regional Science*, Vol. 5, No. 1.

Pal and Pant (1993), " An Alternative Human Development Index" *MARGIN*, Special Issue, Jan–March.

Pareto, V. (1927), *Mannual D' Economic Politique*, Deuxieme Edition, Paris.

Planning Commission (1993), *Report of the Export Group on Estimation of Proportion and Number of Poor*, Perspective Planning Division, Government of India.

Rao, H. (1972), "Identification of Backward Areas", Paper presented in a Seminar on *Regional Imbalance – Problems and Policies*, IIPA, New Delhi.

Rao, S.K. (1973), "A Note on Measuring Economic Distances between Regions in India", *Economic and Political Weekly*, Vol. 8, No. 17.

Samuelson, P.A. (1947), *Foundations of Economic Analysis*, Harvard University Press, Massachusetts.

Schwartzberg, J.E. (1969), "Occupational Structure and Levels of Economic Development in India – A Regional Analysis", *Census of India*, Monograph 4, New Delhi.

Sen, A.K. (1973), *On Economic Inequality*, p. 5, Oxford University Press, New Delhi.

Shariff, A. (1999), *Human Development in India: A Profile for the Indian States in 1990s*, Oxford University Press, New Delhi.

Shiva Kumar, A.K. (1991), "UNDP's Human Development Index — A Composition for Indian States", *Economic and Political Weekly*, Vol. 30, October 12.

Srinivasan K. and A. Shariff (1997), *INDIA: Population and Development Goals*, pp. 1–194, Oxford University Press, New Delhi.

Thurstone, L.L (1947), *Multiple Factor Analysis*, University of Chicago Press, Chicago.

Tilak, Jandhyala B.G. (1991), "Human Development Index for India", *IASSI Quarterly*, Vol. 10, No. 2.

Trabold–Nubler (1991), "The Human Development Index: A New Development Indicator?", *Intereconomics*, Sep–Oct, pp. 236–43.

United Nations Development Programme (UNDP), *Human Development Report* (various isues), Oxford University Press, New Delhi.

United Nations Research Institute for Social Development (UNRISD) (1970), *Contents and Measurement of Socio-Economic Development*, Geneva.

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APPENDIX

TABLE A.1
Economic Development

Region/ State	Male Agricultural Workers Productivity (Rs Per worker) 1992-95 (Min. of Agrl)	Yield of Foodgrains (Kg/ha) 1995-96 (Agl Stat.)	Per Capita Income NCAER 1993-94 (NCAER)	Per capita consumption exp. Per month (Rs) 1993-94 (NCAER)	Percentage Non-poor 1993-94 (NCAER)	Adult Literacy Rate 1993-94 (NCAER)	Net irrigated area as %age to net sown area 1993-94 (Agl. Stat.)	Fertiliser consumption (Kg/ha) 1995-96 (Agl. Stat.)	Power cons. in agriculture (kWh/'000ha) (Agl. Stat.) 1993-94
	Output 1	Output 2	Output 3	Output 4	Output 5	Input 1	Input 2	Input 3	Input 4
Andhra Pradesh	9293	1693	5046	313	79	42.4	37.5	137.3	738
Bihar	2934	1440	3691	218	58	37.6	47.5	77.0	142
Gujarat	10807	1094	5288	291	61	54.6	27.0	68.5	812
Haryana	21871	2539	6368	349	73	48.2	75.8	123.7	677
Himachal Pradesh	6045	1602	4168	440	55	61.3	17.5	30.5	14
Karnataka	11016	1261	4769	236	67	47.2	21.6	75.5	491
Kerala	16830	1943	5778	334	70	87.5	14.9	66.7	86
Madhya Pradesh	8556	1032	4166	208	60	38.5	27.1	34.7	228
Maharashtra	9758	874	5525	240	66	51.2	14.9	65.3	418
North-eastern Rg.	8021	1306	5070	260	67	68.0	21.1	12.8	11
Orissa	6278	1201	3028	211	45	49.2	33.2	25.2	35
Punjab	26967	3471	6380	555	68	53.5	93.3	167.3	832
Rajasthan	9090	804	4229	410	60	34.4	28.3	31.9	190
Tamil Nadu	10943	1918	5122	310	66	58.1	47.4	106.9	797
Uttar Pradesh	7773	1886	4185	306	60	41.2	65.6	101.4	351
West Bengal	7808	1960	3157	286	49	54.6	35.0	99.3	92
Mean	10874	1627	4748	310	63	52.0	38.0	77.0	370

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TABLE A.2
Education

Region/ State	Literacy Rate Total NCAER, 1994	Enrolment Rate in Elementary Education Female NCAER, 1994	Proportion of population (aged 15 & above) completing Middle level education	Proportion of population (aged 15 & above) completing Matric level education	Per Student Annual hh exp. on Elementary Education NCAER, 1994	Public Exp. per student on Elementary Education MHRD 1995-96	Percentage NSDP spend on total education MHRD 1995-96
	Output 1	Output 2	Output 3	Output 4	Input 1	Input 2	Input 3
Andhra Pradesh	50.2	73.8	8.0	8.0	295	222	3.0
Bihar	43.8	51.2	12.1	10.6	375	326	5.1
Gujarat	59.4	74.5	10.6	9.3	278	352	3.5
Haryana	54.9	72.3	11.9	14.8	696	530	2.5
Himachal Pradesh	68.2	90.0	14.5	15.3	842	612	7.3
Karnataka	54.9	75.1	12.6	9.5	383	272	3.9
Kerala	89.6	98.0	25.4	19.5	586	777	6.6
Madhya Pradesh	43.9	55.8	10.5	4.0	258	231	3.4
Maharashtra	58.2	82.3	14.2	6.7	302	349	2.7
North-eastern Rg.	70.0	76.3	24.7	14.5	404	329	6.6
Orissa	54.5	63.4	12.9	6.2	253	283	4.8
Punjab	60.2	84.4	12.8	15.6	670	349	2.6
Rajasthan	40.9	41.9	10.0	3.5	428	377	5.0
Tamil Nadu	64.1	84.3	14.2	10.6	379	332	3.8
Uttar Pradesh	46.7	53.4	12.3	6.9	351	255	3.7
West Bengal	58.5	65.1	13.7	5.4	316	198	3.7
Mean	57.4	71.4	13.8	10.0	426	362	4.3

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TABLE A.3
Health

Region/ State	Short duration morbidity Per '000 pop. NCAER 1993-94	Crude Birth Rate NCAER 1993-94	Crude Death Rate NCAER 1993-94	Total Fertility Rate NCAER 1993-94	Infant Mortality Rate NCAER 1993-94	Child Mortality Rate (Q5) NCAER 1993-94	Life Expectancy at birth CENSUS 1989-1993	Contraceptive Prevalence Rate NCAER 1993-94	Mother Received ANC NCAER 1993-94	Delivery Attended by Trained Person NCAER 1993-94	%age of Children Immunised NCAER 1993-94	% Villages having Sub-centre NCAER 1993-94	% Villages having Pharmacy NCAER 1993-94	% Villages having Anganwadi NCAER 1993-94
	N1	N2	N3	N4	N5	N6	P1	P2	P3	P4	P5	P6	P7	P8
Andhra Pradesh	132	26	16	3.1	66	96	59.7	48.2	79.0	71.9	69.6	26.6	48.7	62.8
Bihar	132	37	10	5.3	67	115	57.7	17.8	53.1	15.7	37.5	6.0	29.3	19.8
Gujarat	57	29	8	3.7	57	76	59.1	50.6	73.7	55.9	74.6	12.5	12.5	79.6
Haryana	153	30	5	4.2	63	97	62.1	43.3	73.6	61.7	73.9	32.2	21.1	82.2
Himachal Pradesh	122	20	6	2.7	70	101	63.6	55.9	67.1	31.6	57.2	20.6	22.2	46.0
Karnataka	122	25	5	2.4	55	75	60.1	51.7	78.0	56.8	73.0	26.7	28.2	83.7
Kerala	89	21	5	2.2	26	40	71.8	58.5	94.4	96.5	78.6	26.7	53.3	70.7
Madhya Pradesh	195	32	9	4.3	122	160	52.3	36.0	39.4	47.8	53.2	16.1	12.9	33.2
Maharashtra	85	28	11	3.7	85	112	62.0	54.2	80.4	48.2	79.0	35.8	19.9	78.8
North-eastern Rg.	94	34	7	3.9	39	51	54.1	27.6	47.6	41.5	28.4	25.6	37.2	53.9
Orissa	143	29	13	3.7	105	135	54.9	33.8	58.9	20.5	52.7	7.8	31.4	45.1
Punjab	154	22	9	3.1	71	102	65.5	45.5	76.2	71.3	62.0	5.7	31.4	35.7
Rajasthan	113	44	12	6.8	107	136	55.6	26.4	32.0	20.3	20.3	30.2	17.0	44.3
Tamil Nadu	168	28	12	3.0	91	119	60.5	41.4	89.8	82.6	82.8	51.3	48.7	75.0
Uttar Pradesh	97	38	11	5.9	99	137	55.0	22.3	42.6	30.4	41.3	13.0	33.3	30.1
West Bengal	164	34	21	4.3	106	139	60.0	32.5	60.3	28.1	31.2	36.4	34.9	37.9
Mean	126	30	10	4.0	77	106	60.0	40.0	65.0	49.0	57.0	23.0	30.0	55.0

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TABLE A.4
Basic Amenities

Region/ State	% hhs using PDS NCAER 1993-94	% hhs living in rented house NCAER 1993-94	% hhs owning television NCAER 1993-94	% hhs owning Radio NCAER 1993-94	% hhs having pucca houses NCAER 1993-94	% hhs having separate kitchen NCAER 1993-94	% hhs having electric connection NCAER 1993-94	% hhs having protected water NCAER 1993-94	% hhs having toilet facilities NCAER 1993-94	%age of villages connected with pucca roads NCAER 1993-94	Road per '000 sq.km. CMIE 1993-94
Andhra Pradesh	66.4	5.6	12.1	41.8	55.3	40.3	63.1	79.6	15.2	44.3	603
Bihar	5.0	1.4	5.6	36.9	28.3	15.9	9.8	68.8	7.3	19.0	505
Gujarat	47.6	6.1	14.1	31.7	62.6	48.5	71.9	87.8	21.9	54.6	550
Haryana	9.0	0.7	40.3	59.7	86.2	45.3	81.9	84.0	8.0	61.1	585
Himachal Pradesh	75.6	2.8	27.3	47.2	42.5	80.9	88.0	73.9	16.2	23.8	519
Karnataka	70.1	6.3	9.9	44.4	25.9	66.5	63.0	80.2	10.6	25.9	728
Kerala	78.0	6.4	18.5	60.0	74.8	89.1	61.1	79.2	63.1	85.3	3551
Madhya Pradesh	34.2	2.2	9.8	36.5	39.3	32.3	50.4	65.9	5.5	21.2	469
Maharashtra	50.7	7.1	14.1	28.1	44.3	51.7	59.7	79.3	5.4	45.0	731
North-eastern Rg.	21.7	1.9	24.4	59.7	33.5	74.0	44.1	61.9	68.0	21.2	860
Orissa	5.2	3.6	6.4	29.8	20.0	45.3	18.8	48.6	3.8	15.7	1371
Punjab	5.6	2.5	38.6	37.3	81.9	48.8	83.5	96.1	19.8	81.4	1131
Rajasthan	23.6	1.6	8.1	23.1	55.6	38.8	49.1	46.8	4.0	40.6	372
Tamil Nadu	82.4	10.9	10.5	48.0	77.6	55.7	63.0	71.6	11.1	40.8	1559
Uttar Pradesh	5.2	2.2	8.2	27.3	41.9	18.1	20.1	70.0	10.7	34.3	717
West Bengal	11.3	8.6	7.7	41.4	17.2	61.1	15.6	77.5	22.2	14.4	693
Mean	37.0	4.4	16.0	40.8	49.2	50.8	52.7	73.2	18.3	39.3	934