

Note on the Human Development Index: Methodology

The Human Development Index was developed by the United Nations Development Programme (UNDP) in its first Human Development Report published in 1990. It is an index to measure the level of human development in countries, to arrive at some comparisons between nations, and to be able to rank countries in order of their status of human development. The UNDP index calculated human development as a measure of education, health and incomes of nations. The basic construction of the index has not changed over the last six years, though many modifications have been made to the way calculations are undertaken to make the index more reflective of human development.

Various measures have been worked on after UNDP developed its Human Development Index (HDI), bringing in modifications and changes in the way data is put together. Based upon the status of education represented by means years of schooling and literacy, health represented by life expectancy, and income based upon per capita income adjusted to poverty line, this index has been differently calculated. There have been significant suggestions to the calculation of the index, made by economists, statisticians and social scientists, notable among which in India are the works by Bhaskar Dutta, Manoj Panda and Wilima Wadhwa, under the UNDP study in India on Human Development, coordinated by T. N. Krishnan, work by NCAER, especially by S.P. Pal and G. Chakarabarty, work by K. Seeta Prabhu and Somnath Chatterjee under the Development Research Group (Department of Economic Analysis and Policy, RBI), etc.

This report looked at the HDI developed by UNDP, and various other studies on developing a human

development index. The district-wise human development index developed for this report is inspired by the UNDP HDI. However, it has been modified wherever necessary, depending on availability of district-level data. The Project undertook a study of district-level data, from the process of data generation and collection to its collation, aggregation and publication, from one to many sources and from many to single sources, in the government and non-government institutions and publications. During this extensive exercise, the project was able to select data that can be utilized in spite of the problems concerning data in the districts. There is a large amount of data that is generated, but much had to be rejected due to the following reasons.

- *Differences in interpretation of data* in districts and some times within districts.
- *Accounts-led approach* to collection of much of the data, where accounting or target-filling is the prime objective rather than reporting a truer picture. This approach creates problems in health programmes like immunization, where each shot or medicine given is accounted for as one, even though the full process of medical treatment may not take place, thereby leaving a large gap between reported application of medicines and actual effect.
- *Programme target-led data collection.* As many programmes and objectives are specified in terms of targets, data collection on these programmes also becomes target oriented and tends to show target achievement. This does not indicate that data is untrue, but that it does not truly reflect the picture. For example, in school enrollment, the tendency is to show full or near enrollment by teachers (under pressure of full enrollment targets) even though the children enrolled may not attend school.

- *Benefit-led data reporting.* In data drawn from surveys, people surveyed tend to show a worse picture of themselves than actual, as it leads to benefits, such as the IRDP poverty survey. In this case functionaries conducting surveys tend to be partial towards the surveyed and there are errors on the side of over reporting of numbers and under-reporting of incomes, assets, etc.
- *Lack of data across districts and during a comparable period of time.* Much data is not reported for periods, and districts thus cannot be compared. For example, in the District Statistical Handbooks, data on factories was not available for some of the districts like Surguja, Bilaspur, Balaghat, etc., and data on telephones was not available for districts like Narsimhapur.
- *Differences in data between department, and district and state levels.* This occurs as departments often lack proper coordination on new data or changes in data. Thus, changes in old data are not uniformly reported and collected across districts. For example, there are different figures for number of villages, and departments often use different figures without clearly reporting the figures; this causes confusion in districts and in comparing village-level data.

Much of the good data collected and available, is not accessible, simply because the departments and agencies managing them either do not have the resources to collect, collate and publish them regularly, or just do not do it.

There is seriousness in data for state-level indicator, but not for districts, since districts presently do not allocate resources in a significant way. The Finance Department, other nodal departments and the State Planning Board are state-level decision-making bodies.

There are a lot of studies, estimates and surveys made at the national and state levels that enable many of the calculations and estimates that go into developing the state NSDP. These are absent at the district level, either totally or at the same level of detail, whereby it becomes extremely difficult to make district-level estimates of incomes, district domestic product etc.

The Madhya Pradesh Human Development Index (MPHDI) for its districts, like the HDI developed by UNDP, also looks at the status of education, health and income in each district, and then ranks them on the combined status in all these fields.

INDEX OF DEPRIVATION

The index calculated for each criterion selected is a figure showing the level of deprivation in a criterion that a district suffers, compared to the best district in that criterion. This index is a measure of how far a district is from the achievable target

The index is calculated by the following formula:

$$\text{IOD } ij \text{ (Index)} = \frac{\text{Target } j - \text{Value } ij}{\text{Target } j - \text{Min } j}$$

IOD ij = Index of deprivation for the I th district for the j th criterion.

Target j = This is the maximum achievable target for the j th criterion (for example, it is 100 percent literacy)

Value ij = This is the value of the I th district for the j th criterion

Min j = This is the minimum value for the j th criterion amongst all the districts of Madhya Pradesh.

For example, in calculating the Index of Deprivation for literacy of Durg:

Target for literacy = 100.0 %
 Minimum literacy in districts = 19.0 %
 Literacy of Durg = 58.7 %

The calculation is:

$$\frac{100 (\text{Target literacy}) - 58.7 (\text{Literacy in Durg})}{100 (\text{Target literacy}) - 19.0 (\text{Minimum Literacy})}$$

Therefore, Index of Deprivation for Durg in literacy = 0.51

The criteria used for the district HDI and the methodology applied for the Madhya Pradesh Human Development Index (MPHDI) for districts are given below. It needs to be mentioned here that the calculations for the indices and the data used for such calculations should not be used in isolation from the index, since much of the district data used is relevant in comparing districts and may not be a proper indicator in isolation from the index.

EDUCATION

UNDP uses literacy rate and mean years of schooling. In the MPHDI, literacy rates has been used as one of the two parameters for education.

Literacy denotes the most basic and essential education criterion. Literacy levels are available for each district from the Census of India, 1991, and these figures were used for the index on literacy. Literacy rate for population was calculated as percentage share of all literates in a district over the total population of people above 6 years of age in the district.

Literacy has also been assessed by the National Literacy Mission groups in districts. This figure, however, was not available to us from all the districts at the time of publishing of this report.

The literacy rate for the population, does not properly show the poor levels of female literacy. Female literacy is a critical indicator of education and of the welfare of a family and children, and the Government of Madhya Pradesh has accorded the highest priority to female literacy. In order to make the IOD on literacy sensitive to female literacy, the index uses female literacy with literacy of total population to get a better picture of a district's status in literacy. The total index for literacy is a combination of the two, taking a weighted average of 2/3 for total literacy and 1/3 for female literacy.

The value of weightages given to total and female literacy to sensitise the former by the latter is value judgment may vary.

For the target maximum figure for the purpose of calculating the Index of Deprivation in literacy, we use 80 per cent. This is drawn from the National Literacy Mission targets for literacy. The use of 80 per cent should not be seen as a target for literacy, but only as a figure against which we compare districts. The same target maximum is used for female literacy and total literacy.

It was not possible to calculate the mean years of schooling for the districts. While enrollment data is available in blocks and districts for different classes, longitudinal data (at least 12 years time series) from districts was not available at the time of publication of this report. Though enrollment data is available in districts, there were problems of retrieval of data for years prior to 1990s. In its place, we took the ratio of all children enrolled in schools upto class XII in a district, to the estimated population in the age group 6-19 years of age in the district. Since age-wise population figures for the 1991 census were not released at the

time of publication of this report, we had to rely on estimates for population in these age groups based upon 1971 and 1981 age-wise population figures (except for Bhopal and Rajnandgaon which was created in 1972, and in their case we had to rely on 1981 data only). The basic idea of using this figure is to get an assessment of the use of the school education system and a surrogate for the level of education of the population.

There is a problem in using enrollment data, since studies have shown that enrollment figures for lower classes are often overstated to fit the targets of enrollment figures for lower classes are often overstated to fit the targets of enrollment. Since the basic purpose of the index is comparability across districts, in the absence of other data, we used enrollment data, assuming that the error on the side of exaggeration is basically uniform across districts.

The target maximum for this figure is difficult to assess, since the age group 6 to 19 includes ages at which many children would have passed out of school after fully completing it, and would therefore not be counted. However, as we have no estimates to arrive at an acceptable figure for a target maximum for calculating the index of deprivation in school enrollment, we use 100 percent as the target maximum.

The two indices were combined to get the Index of Deprivation for education. The indices were combined in a weighted average, with 2/3 for literacy and 1/3 for all children in schools. A higher weight for literacy was taken to give importance to this most essential criterion and keeping in mind the problems of data in enrollment figures.

HEALTH

UNDP uses life expectancy as the health parameter to assess health status. Data for life expectancy is available for the period 1971 to 1981, but as Bhopal and Rajnandgaon districts were formed only after the 1971 Census, life expectancy for these two districts was not available to us. Age-wise distribution from the 1991 Census is not available as yet, and therefore calculations of life expectancy for the period 1981 to 1991 are not yet possible.

In place of life expectancy, we use *infant mortality rate* (IMR). Data on IMR drawn from the 1991 Census is still not available. Data on district-wise IMR was collected from the Registrar General of India (Occasional Paper No.7, 1981, Fertility and Child Mortality, Estimates of Madhya Pradesh, Registrar General of India). Other sources for calculating IMR like the Sample Registration Scheme (SRS) give IMR data for the state but are statistically not significant and cannot be used for districts. The Civil Registration System (CRS) data records birth and deaths in districts, but is not reliable due to heavy under-reporting, and therefore could not be used for district IMR. Further, there are no other sources for data giving IMR uniformly for all districts for recent years.

The infant mortality rate is calculated by the number of deaths of children under 1 year of age in a district by per 1,000 live births in a year in the district. IMR indicates the status and delivery of basic health services, level of health awareness and practices, child delivery and family planning practices, and reflects on the condition of sanitation. It is thus a very critical indicator of the status of health of people in a district. For the target maximum for IMR we use the figure of 60,

drawing from the national goals for reducing IMR by the end of century.

INCOME

The UNDP HDI uses ‘adjusted per capita income for countries’ to calculate the index, two criteria have been used. Since it is extremely difficult to assess district domestic products, and thereby come to an assessment of per capita income, we have used district incomes derived from the net state domestic product (NSDP) for our use. The other criterion applied was rural poverty rates.

District Incomes

Data for calculating the district domestic product (DDP) is not available to enable a district-to-district calculation. The state domestic product is calculated under 16 categories by using sources from the state’s own production and economic activities (such as for agriculture, fisheries, forest, electricity, etc.), by estimating volume of products from different sources using centrally administered surveys by CSO, ASI, etc. (for railways, industry, unregistered manufacturing, gas, water) and a mix of various sources. Unfortunately this is not available for districts, and we had to resort to other means to divide SDP district-wise, under the 16 major categories.

A note of caution is necessary here. Calculating district-level incomes is a difficult task given the lack of data at this level of aggregation. What was needed for developing an index based on income was to get district-level figures that would indicate the relative strength of districts in terms of per capita incomes drawn from estimates of share of districts to the state NSDP. Per capita incomes were calculated by dividing district shares of state NSDP

by district population to arrive at comparable per capita incomes for districts. Further, the district shares of NSDP, and the per capita incomes derived from these estimates, are neither a substitute nor a surrogate for district domestic product and per capita incomes from it, but only a comparable figure for districts for this report.

The state NSDP is calculated under the 16 categories, using different methods for each category. Much of the calculations and adjustments are made on the basis of estimates and data from CSO and other studies and applied to state-level data, to arrive at state-level estimates. For example, in unregistered manufacturing, estimates of value added for unregistered manufacturing for 5-digit level of NIC is derived from the 1984-84 survey of directory manufacturing establishments (DME), non-directory establishments (NDE), and own account enterprises. The industry-wise estimates are adjusted by moving them backwards and forwards for the current year’s estimates. Since district-level figures for DME and NDE are not available separately and or under 5-digit levels, we attempted to estimate district shares of unregistered manufacturing by using data on establishments and own account enterprises available district-wise (rural and urban) from the provisional results of the Economic Census 1990 (though the results of the survey are not officially released, we have used the data only for our estimates). Similarly, calculations for district shares are somewhat related to or correspond to, wherever possible, with the methodology of the NSDP.

For some categories like agriculture, industry, mining, forestry, banking and public administration fairly good district-level indicators were available that were used to distribute the domestic product of these categories along districts. Using different indicators, share of districts (in percentage) to the specific domestic product was estimated, and this

share was applied to the domestic product of that category to arrive at district-level domestic product for that category.

For example, in agriculture, using production data of major produce, and applying state-level prices of different crops to the production of each, we got a total output value of major crops for each district. The total state-level value of production for such crops was Rs.5,76,99,541 for 1991-92. The value for Morena was Rs.20,88,929 and for Panna it was Rs.5,66,753 which amounts to a share of 3.62 percent and 0.98 per cent respectively. This share was applied to agriculture domestic product value of Rs.10711.74 crore and district shares for Morena and Panna, therefore, were Rs.387.8 and Rs.105.2 crore respectively. Similarly, shares for different categories for each district were arrived at and these shares (in percentage terms) were applied to the domestic product of the category.

For other categories we used data for employment, own account enterprises and establishments, etc. to arrive at district-level shares.

The methodology used for the major categories is given below. In all, 74.4 percent of the net state domestic product for 1991-92 was allocated to districts on these lines. The share of the 16 categories of NSDP is given in what follows.

1. *Agriculture (including Animal Husbandry)*

Data was not available for agriculture, horticulture and animal husbandry separately. To estimate district shares of agriculture (including livestock production), district-wise production of all major produce such as cereals, pulses and oilseeds was taken and state's average prices for these were applied to get the district production in price for agriculture. The agriculture domestic product was then divided along districts according to the share of each district to the total production (in price) in cereals, pulses and oilseeds.

2. *Forestry and Logging*

Data for production of major and minor forest produce is available circle-wise and not district-wise, it is not easily accessible, and could not be divided into districts. This was therefore left out from our calculation.

3. *Fisheries*

Data on district-wise fish production, the value of fish, and other fishery-related data was available from the Fishery Department, and the domestic product corresponds largely to these figures. Fisheries domestic product was allocated to districts accordingly.

4. *Mining and Quarrying*

Data on production and value of production as well as royalty and cess from all major and minor minerals in the state was available district-wise. The share of each district to the total production value, and revenue from mining was taken and applied to the mining and quarrying domestic product of the state to arrive at district-wise figures.

5. *Manufacturing – Registered*

In small scale industries (SSI), we had data on district-wise number of small scale units (SSI) and investments in them to date, and current employment. The Annual Survey of Industries gave district-wise data on SSI units, employment, fixed investment, and gross and net value added. For assessing contribution of SSI per district, we did a regression analysis between net value added (dependent variable) and units of SSI and fixed investment (dependent variable) and units of SSI and fixed investment (independent variables). Using this equation, we arrived at an estimate of net value added by SSIs in each district for 1991-92, and the share of each district to this overall estimated SSI net value added was taken as the

share of district SSIs to total SSI contribution to the registered manufacturing domestic product.

Data was difficult for turnovers and outputs in the large and medium scale industries (LMI) sector. Available data gave us annual district-wise large and medium scale industry investments, with current employment. We calculated the share of each district to LMI contribution to registered manufacturing domestic product by first adjusting the total LMI investment to the price levels of 1950-51, using the wholesale price index for industrial products. This was used to measure the district-wise investment in LMI. We estimated from fieldwork, data available from surveys and regression analysis from available turnover and output data, the relative contribution of data of LMI units, employment and investment (adjusted) to total LMI sector. According to this estimate, LMI units was multiplied by a factor of 2, investment by 4 and employment by a factor of 1, and the weighted average of the total gave us a comparable column of data to calculate district-wise shares of LMI. The share of each district in this table was taken to be the share of district to LMIs share of registered manufacturing domestic product.

The SSI and LMI weighted share was taken together assigning a weight of 4 to LMI and 1 to SSI, and share of district to total states share, was applied to state domestic product in manufacturing – registered.

6. Manufacturing – Unregistered

For NSDP, unregistered manufacturing is calculated by using net value added from the 1984-85 survey on directory manufacturing establishments, non-directory establishments, and own account enterprises, which gives data for digit-level under the NIC classification. District-wise distribution of

DME and NDE is not available, and, data on establishments is not available below 1-digit NIC.

We took data for unregistered manufacturing from the Economic Census 1990 (provisional for Madhya Pradesh). The Economic Census gives district-wise number of own account enterprises (non-agriculture) and establishments in manufacturing. No data was available to get a share of OAE, and establishments to unregistered manufacturing. We added up the number of OAE to establishments for every district. The resultant sums were divided by the total number of OAE and establishments in the state, to get percentage shares for each district. These shares were assumed to correspond to district shares of the domestic product of manufacturing –unregistered. This share was applied to manufacturing unregistered domestic product to arrive at district shares.

7. Construction

In construction district-level data was scarce, and wherever available was not consistent or available in all districts. In the absence of such figures we had to resort to the provisional data from the Economic Census, 1990.

Taking figures of own account enterprises in construction, they were added to the number of establishments in construction in each district. The sums were divided by the total number of OAE and establishments in construction in the state. The shares so arrived at were taken as its share in construction domestic product.

8. Electricity, Gas and Water

No satisfactory estimates could be developed due to absence of disaggregated data, especially for gas and water, and this category was thus left out.

9. Railways

No data was available to estimate district-wise share in railways. Scattered data on trains, railway lines and stations were not available for most districts, disabling us from making any kind of assessment.

10. Transport by other means and Storage

No satisfactory data was available to assess transport by other means.

11. Communication

No data was available to satisfactorily assess district share in communications.

12. Trade, Hotels and Restaurants

No data was available to satisfactorily assess district share in trade, hotels and restaurants.

13. Banking and Insurance

Banking and Insurance domestic product was divided on the share of each district on the deposit and loans in each district over the last five years.

14. Real Estate, ownership of Dwellings and Business Service

No satisfactory data was available for this category.

15. Public Administration

This was based upon estimates of expenditure on Public Administration supplied by each district and allocation of other funds on the basis of the strength of the employment of state administration employees in each district, on a weighted average from Class I to temporary and daily wages.

16. Other Services

Figures for employment under other services were taken from the 1991 Census. The employment figures were divided by the total employment in the other services in Madhya Pradesh to arrive at district shares, and these shares were applied to domestic products from other services to arrive at district figures.

Adjusted Income

Incomes so calculated were divided by the population of the district to arrive at the capita district income. These figures calculated from 74.4 percent of NSDP of the state in 1991-92 are not adjusted and can present a distorted picture of districts, especially in ranking the maximum and minimum values of districts express the range for calculation. We have used the formula used by UNDP to adjust the per capita income based upon the poverty line figure of the Planning Commission.

We calculated district-wise poverty line, by taking the poverty line developed by the Planning Commission based upon the per capita monthly expenditure separately for the rural and urban adjusted to the 1991-92 prices. This figure was multiplied by 0.744 to make it comparable with our allocation of 74.4 percent of NSDP. To arrive at district poverty line figures, we took a weighted average of rural and urban population with adjusted rural and urban poverty line figures. The per capita incomes calculated for each district were divided by the resultant poverty line for each district, the product indicating the number of times district per capita was to the poverty line. To use Atkinson's formula and derive adjusted district incomes, we need one poverty line to compare districts. To enable this, the state's poverty line based upon the Planning Commission's adjusted poverty line was used (weighed to rural and urban), and district per capita incomes were calculated on comparative score by multiplying the factor arrived earlier by the state poverty line.

Using Atkinson's methodology (based upon the principles of Marginal Utility of Income above the poverty line), per capita income above the poverty line were adjusted. Adjustments were undertaken to arrive at the figures of income that give a comparative strength of districts, not overly distorted by the range of incomes between districts. The adjusted per capita incomes appear to be brought down and the range of income reduced substantially (from a high of Rs.7,201 and a low of Rs.2,149 to an adjusted high of Rs.1,926 and low of Rs.1,806). However, the adjustment is only for the basis of developing an index, and the reduced range and reduced high and low ensure that the value of the Index of Deprivation are not too skewed against districts with lower per capita incomes. There is also a positive correlation of 0.96 between the adjusted per capita income IOD and the total per capita income IOD.

Poverty Index

The scale of poverty is the most important indicator of the welfare of people in the district. Data from IRDP surveys on the rural poverty (Development Commissioner, Government of Madhya Pradesh) are available for 1992, but the urban surveys are still going on and have not been finalized. We used data on rural poverty to develop this indicator. Further, the methodology of calculating district domestic product is very subjective and not at all definite, so the importance of this figure is even greater.

Rural poverty statistics for each district were derived from the rural poverty survey. From the share of rural poor to total rural population, the index of rural poverty was developed.

The survey also provides us information on families under the four income categories under the Rs.11,000 per annum per family norm for rural poverty. Taking the weighted average of incomes of families in each category, the average income for people below poverty line was calculated. The average income was divided by the minimum expected income to raise above the poverty line of Rs.10001, and an index denoting the level of deprivation of poor was calculated.

The two indices were then combined by assigning a weight of 4 to the rural poverty index and 1 to level of deprivation of poor, to get an index of poverty. We give a very high weight to poverty, as it would otherwise reduce the impact of sheer poverty on the index for a district.

Finally the indices of poverty and income were combined as simple composite index, to arrive at the Index of Deprivation for income.

The three indices of Deprivation (IOD) for health, education and income are then combined in a simple average to get the index of Deprivation. By separating one from the IOD, the Human Development index for all the districts was calculated.