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Human Development: Conceptual and Measurement Issues

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Abstract

The human development approach to development and growth as proposed by UNDP in 1990 is a widely accepted approach all over world. This paper in this connection is an attempt to describe in details about evolution of the concept of human development, its emergence as an approach to development and the methodological issues on its measurement. It provides an account of various changes in the methods of measurement brought out by UNDP, the Planning Commission, Government of India and the individual researchers at different points of time since1990.

Introduction

Development experience of many fast-growing developing countries revealed that their high GNP growth rates failed to reduce the socio-economic deprivation of substantial sections of their population. Even developed industrial nations realized that high income is no protection against the rapid spread of such problems as drugs, alcoholism, AIDS, homelessness, violence and the breakdown of family relations. At the same time, some low-income countries demonstrated that it is possible to achieve high levels of human development if they skillfully use the available means to expand basic human capabilities. This establishes the fact that the expansion of output and wealth is only a means to development. The end of development is the welfare of human beings. Therefore, the central focus of development analysis and planning must be directed towards people's needs and oriented towards achievement of this ultimate end. As a first step towards achievement of this end there is a need to create a database on improved social statistics and new development measures. To cater to this need the concept of human development and its measurement through a measure called Human Development Index (HDI) was introduced by UNDP (1990) in its first Human Development Report.

The human development approach of development as is commonly understood differs from the conventional approaches to economic growth, human capital formation, human resource development, human welfare and basic human needs. The following arguments help us in understanding the same: (1) GNP growth is treated as being necessary but not sufficient for human development. Human progress may be lacking in some societies despite rapid GNP growth or high per capita income levels unless some

additional steps are undertaken to improve the same. (2) Theories of human capital formation and human resource development view human beings primarily as means rather than as ends. They are concerned only with the supply side, with human beings as instruments for furthering commodity production. It is true that human beings are the active agents of all production and wealth creation but they are also the ultimate ends and beneficiaries of this process. Thus, the concept of human capital formation (or human resource development) captures only one side of human development, but not in its entirety. (3) Human welfare approaches look at human beings more as the beneficiaries of the development process than as participants in it. They emphasize only the distributive policies rather than production structures. (4) The basic needs approach usually concentrates on the bundle of goods and services such as food, shelter, clothing, healthcare and water that deprived population group needs. It focuses on the provision of these goods and services rather than on the issue of human choices.

Concept of Human Development

Human development is a process of enlarging people's choices. In principle, these choices can be infinite and can change over time. But, at all levels of development, the three essential choices are for people to lead a healthy and long life, to acquire knowledge and to have access to the resources needed for a decent standard of living. If these essential choices are not available, many other opportunities remain inaccessible. But human development does not end there. Additional choices, highly valued by many people, range from political, economic and social freedom to opportunities for being creative and productive and enjoying self-respect and guaranteed human rights.

Human development has two sides: (1) the formation of human capabilities such as improved health, knowledge and skills and (2) the use of theirs acquired capabilities for productive purposes, leisure or for being active in cultural, social and political affairs. Considerable human frustration results if the scale of human development does not finely balance the two sides. In this sense income is clearly one of the options that people would like to have, albeit an important one. But it is not the sum total of lives. Development must, therefore, be more than just the expansion of income and wealth. Its focus must be on people (HDR, 1990). The HDR (1991) elaborates the concept of human development along the following lines: People must be at the center of human development. Development has to be woven around people, not people around development. It has to be development of the people, by the people and for the people.

Previous concepts of development have often given exclusive attention to economic growth on the assumption that the benefits of growth would trickle down to various sections of the society. But the past experience does not support this hypothesis much. Higher growth does not necessarily bring higher degree of welfare for every section of the society. Growth needs to be translated into improvements in people's lives.

Human development also encompasses elements that constitute the critical issues of gender and development. There are four major elements in the concept of human development such as productivity, equity, sustainability and empowerment. As far as productivity is concerned people must be enabled to increase their productivity and to participate fully in the process of income generation and remunerative employment to achieve higher economic growth, which is a subset of human development models. Productivity is not the only means to achieve welfare in a society. People must have access to equal opportunities. All barriers to economic and political opportunities must be eliminated so that people can participate in, and benefit from, these opportunities. These benefits also need to be distributed over generations. Access to opportunities must be ensured not only for the present generation but for future generations as well. All forms of capital such as physical, human and environmental should be replenished. Besides, empowerment is a necessity as regards human development is concerned. People must participate fully in the decision making process that can shape their lives. Human development is impossible without gender equality. As long as women are excluded from the development process, development will remain weak and lopsided (HDR, 1995).

Development should increase people's choices with two caveats. First, while enhancing the choices of one individual or a section of a society, should not restrict the choices of another. This calls for equity in human relationships. Second, while improving the lives of the present generation should not mortgage the choices of future generations (HDR, 1991). In other words, the development process must be sustainable. The concept of human development has gone beyond its basic premises to emphasize the sustainability of the development process. It not only puts the people at the center of the development process but also advocates protection of the opportunities of future generations and respecting the natural systems on which all life system depends. Sustainable human development addresses both equity within the generation and among the generations enabling all generations, present and future, to make the best use of their capabilities.

The issue of sustainability has three dimensions such as capacity, environment and institutions. If the development process does not create institutions fully supportive of people's rights, it cannot be sustainable in the long run. Human development thus

emphasizes strengthening the institutions of both government and civil society so that the entire development process becomes internally sustainable (HDR, 1995). Human development is not a concept separated from sustainable development but it can help to rescue 'sustainable development' from the misconception that it involves only the environmental dimension of development. All these approaches have emphasized the need for people–centered development, with concerns for human empowerment, participation, gender equality, equitable growth, poverty reduction and long-term sustainability (HDR, 1998). According to Haq (1976), "the defining difference between the economic growth and the human development schools is that the first focuses exclusively on the expansion of only one choice, i.e. income, while the second embraces the enlargement of all human choices whether economic, social, cultural or political".

There are at least six reasons for which we talk and aspire for human development and poverty eradication. First, it is an end in itself; indeed it is the whole purpose of development. Second, it contributes to higher productivity. Third, it lowers re-productivity and therefore controls population growth. Fourth, poverty reduction reduces degradation of environment from soil erosion, deforestation and desertification. Fifth, the growth of a civil society and democracy leads to greater social stability. Lastly, its political appeal is that not only it reduces civil disturbances but also acts as a means to political stability (Streeten, 1995).

Measurement of Human Development: UNDP Method

What does the HDI include? How is it measured? These are some the few questions which need to be addressed first. The HDI is a composite index of three basic components of human development, viz. longevity, knowledge and standard of living. Longevity is measured by life expectancy. Knowledge is measured by a combination of adult literacy having two-thirds weight and mean years of schooling with one-third weight. Standard of living is measured by purchasing power, based on real GDP per capita adjusted for the local cost of living (purchasing power parity, or PPP).

The question then arises: Why do we take only these three components to measure human development? In any system of measuring and monitoring human development, the ideal could have been to reflect all aspects of human development to obtain as comprehensive a picture as possible. In support of the choice of three components of HDI, the following arguments are made in HDR (1990): One of the probable reasons is lack of data that imposes some limits on its measurements. Secondly,

comprehensiveness is not always and entirely desirable. Too many indicators may produce a perplexing picture, perhaps distracting policy makers from its thrust. Moreover, some indicators may overlap with existing indicators. Infant mortality, for example, is already reflected in life expectancy. Thus, arbitrary inclusion of more indicator variables may not solve the purpose for which the index is constructed. The crucial issue has therefore been on emphasis on the policy variables.

The next question then arises: How to combine these three indicators measured in three different units? The breakthrough for the HDI, however, is to find a common measuring rod for the socio-economic distance traveled. For each of these three dimensions, the report identified minimum achievements, viz. the lowest national life expectancy, the lowest national level of adult literacy and the lowest national level of per capita income. It also established a maximum or desirable level of attainment for each of these dimensions and then showed where each country stood in relation to these scales. It was expressed in terms of a numerical value between 0 and 1. Income above the average world income was adjusted using a progressively higher discount rate. The scores for the three dimensions were then averaged in an overall index.

The HDI was constructed in three steps: In the first step the measure of deprivation of a country was made for each of the three basic indicators using the following formula:

$$(1)\ldots\ldots\ldots\ldots\ldots\ldots I_{ij} = \frac{Max(X_{ij}) - X_{ij}}{Max(X_{ij}) - Min(X_{ij})}$$

The indicator variable (I_{ij}) used in (1) refers to the deprivation indicator for the j^{th} country with respect to the i^{th} variable. In the second step an average deprivation indicator (I_j) was defined by taking a simple average of the three indicators as given below:

$$(2)\ldots\ldots\ldots\ldots\ldots\ldots I_j = \frac{1}{3}\sum_{i=1}^{3} I_{ij}$$

In the third step *HDI* was measured as one minus the average deprivation index as follows:

$$(3)\ldots\ldots\ldots\ldots\ldots\ldots HDI_j = 1 - I_j$$

The human development index attracted a lot of attention among policy makers, development professionals, academics, the press and the people. Many criticisms were

raised against the construction and robustness of the index. As a result of these criticisms two improvements were brought out in its construction in the subsequent HDR (1991). First, knowledge variables such as adult literacy and years of schooling were combined to produce a synthetic measure of educational achievement by assigning weights to the two components as follows:

$$(4)\ldots\ldots\ldots\ldots\ldots\ldots E = a_1(Literacy) + a_2(Years\ of\ Schooling)$$

The symbols used, i.e. E, a_1 and a_2 in equation (4) respectively refer to educational achievement, respective weights of literacy and mean years of schooling. These weights were assumed as $a_1 = ⅔$ and $a_2 = ⅓$ in the 1991 report whereas the same were taken as $a_1 = 1$ and $a_2 = 0$ in the 1990 report. Second, modification was made in the treatment of income. As we know HDI in the 1990 report was based on the premise of diminishing returns from income which was reflected through the use of logarithm of income and assignment of zero weight to income above the poverty line. However, in 1991 the method was revised by using the well-known and frequently used Atkinson formula for measuring utility of income as follows:

$$(5)\ldots\ldots\ldots\ldots\ldots\ldots W(Y) = \frac{1}{1-\varepsilon}(Y^{1-\varepsilon})$$

Where $W(Y)$ is the utility or well-being derived from income, and the parameter ϵ measures the extent of diminishing returns. It is the elasticity of the marginal utility of income with respect to income. If $\varepsilon = 0$ there is no diminishing returns. If ε approaches 1, the equation becomes:

$$(6)\ldots\ldots\ldots\ldots\ldots\ldots W(Y) = Log(Y)$$

The modification adopted in the HDI (1991) was to let the value of ϵ to rise slowly with rise in income. For this purpose, the full range of income was divided into multiples of the poverty line income (Y^*). Thus, most countries were falling in the income range between $0\ to\ Y^*$, some between $Y^*\ to\ 2Y^*$, even fewer between $2Y^*\ to\ 3Y^*$ and so on. For all countries for which $Y < Y^*$ (the poor countries), ϵ was set equal to 0 meaning thereby that there was no diminishing returns. For income between $Y^*\ and\ 2Y^*$, ϵ was set equal to ½. For income between $2Y^*$ and $3Y^*$, it was set at ⅔ and so on. In general,

when $\alpha Y^* \le Y \le (\alpha+1)Y^*$, it implied that $\in = \frac{\alpha}{\alpha+1}$ (where α representing constants such as 1, 2, 3, 4, etc to be multiplied with poverty line income to determine various ranges of income where a country falls according to its level of income). Thus, we have

$$(7)\ldots\ldots\ldots\ldots W(Y) = Log(Y)\ for\ 0 < Y \le Y^*$$
$$= Y^* + 2(Y - Y^*)^{1/2}\ for\ Y^* \le Y \le 2Y^*$$
$$= Y^* + 2(Y^*)^{1/2} + 3(Y - 2Y^*)^{1/3}\ for\ 2Y^* \le Y \le 3Y^*$$
$$= Y^* + 2(Y^*)^{1/2} + 3(Y^*)^{1/3} + 4(Y - 3Y^*)^{1/4}\ for\ 3Y^* \le Y \le 4Y^* \text{ etc.}$$

So, the higher the income relative to the poverty level, the more sharply the diminishing returns affects the contribution of income to human development. Income above the poverty line thus has a marginal effect, but not a full dollar-for-dollar effect. This marginal effect is enough, however, to differentiate significantly among industrial countries. The original HDI formulation (HDR, 1990), by comparison, was:

$$W(Y) = Log(Y)\ for\ 0 < Y \le Y^*$$
$$= Log(Y^*)\ for\ Y > Y^*$$

The revision thus does not take $\in = 1$, but allows it to vary between 0 and 1 (HDR, 1991).

The calculation of HDI for 1994 was again made different from that of the previous years. Maximum and minimum values were fixed for the four basic variables such as life expectancy $(85.0\ and\ 25.0\ years)$, adult literacy $(100\ and\ 0\ per\ cent)$, mean years of schooling $(15.0\ and\ 0\ years)$ and income $(PPP\ \$40{,}000\ and\ 200)$. For income, the threshold value was taken to be the global average real GDP per capita of $PPP\ \$5120$. Multiples of income beyond the threshold was discounted using a progressively higher rate (HDR, 1994).

Since the publication of the HDR (1994), two changes have been brought out in the construction of HDI relating to variables and minimum and maximum values. First, the variable of mean years of schooling has been replaced by the combined primary, secondary and tertiary enrolment ratios mainly because the formula for calculating mean years of schooling is complex and has enormous data requirement. Second, the minimum value of income has been revised from $(PPP\ \$200\ to 100)$. This revision has been made because in the construction of the gender-related development index (GDI) for different countries, the minimum observed value of female income of $PPP\ \$100$ has been used as a lower goal post. It is necessary to use this fixed minimum for construction of the overall

HDI to maintain consistency between the construction of *HDI* and that of *GDI* and to ensure comparability between the two indices. For *HDI* , the revision is only marginal and it has little effect on *HDI* values. For any component of the *HDI* , individual indices are computed according to the general formula:

$$(8)\ldots\ldots\ldots\ldots\ldots Index = \frac{X_i - Min(X_i)}{Max(X_i) - Min(X_i)}$$

For the construction of the dimension indices maximum and minimum values have been fixed as shown in the following Box:

DIMENSION INDICES		
Indicators	**Scaling Norms for HDI**	
	Maximum	**Minimum**
Life expectancy at birth (years)	85	25
Adult literacy rate (per cent)	100	0
Combined gross enrolment ratio (per cent)	100	0
GDP per capita (PPP US $)	40,000	100

Source: HDR 2005, UNDP

Up to1999 Atkinson formula was used to construct the income (GDP) index in the Human Development Report. The basic approach in the treatment of income was driven by the fact that achieving a respectable level of human development does not require unlimited income. To reflect this, income was always discounted in calculating the HDI. To calculate the discounted value of the maximum income of *PPP* \$ 40,000 which falls between the income range of $6Y^*$ and $7Y^*$ the following formula (constructed before 1999) was used:

$$(9)\ldots\ldots W(Y) = Y^* + 2(Y^*)^{1/2} + 3(Y^*)^{1/3} + 4(Y^*)^{1/4} + 5(Y^*)^{1/5} + 6(Y^*)^{1/6} + 7(40000 - 6Y^*)^{1/7}$$
$$= 6311(PPP US\$)$$

The main problem with this formula is that it discounts the income above the threshold level very heavily, penalizing the countries in which income exceeds the threshold level. It reduces the *PPP* \$ 34,000 between the threshold and maximum level of income to a mere *PPP* \$ 321. In many cases income loses its relevance as a proxy for all dimensions of human development other than a long and healthy life and knowledge. To overcome this problem the HDR (1999) brought out a thorough review of the treatment of income and suggested its improvements. Putting the methodology on a more

solid analytical foundation by introducing the formula as shown below made the refinement:

$$(10)\ldots\ldots\ldots\ldots\ldots\ldots W(Y) = \frac{Log(Y) - Log\{Min(Y)\}}{Log\{Max(Y)\} - Log\{Min(Y)\}}$$

There are several advantages to this formula. First, it does not discount income as severely as the formula used earlier. Second, it discounts all income, not just the income above a certain level. Third, the asymptote starts quite late, so middle-income countries are not penalized unduly; moreover, as income rises further in these countries, they continue to receive recognition for their increasing income as a potential means for further human development (HDR, 1999).

Subsequently Anand et al (1993, 1995 and 2000) and Chaubey (2002) suggested further modifications to the UNDP formula but these are yet to be popularized (Nayak and Thomas, 2007). Anand and Sen suggested the following two forms for rectification of the transformation adopted by UNDP:

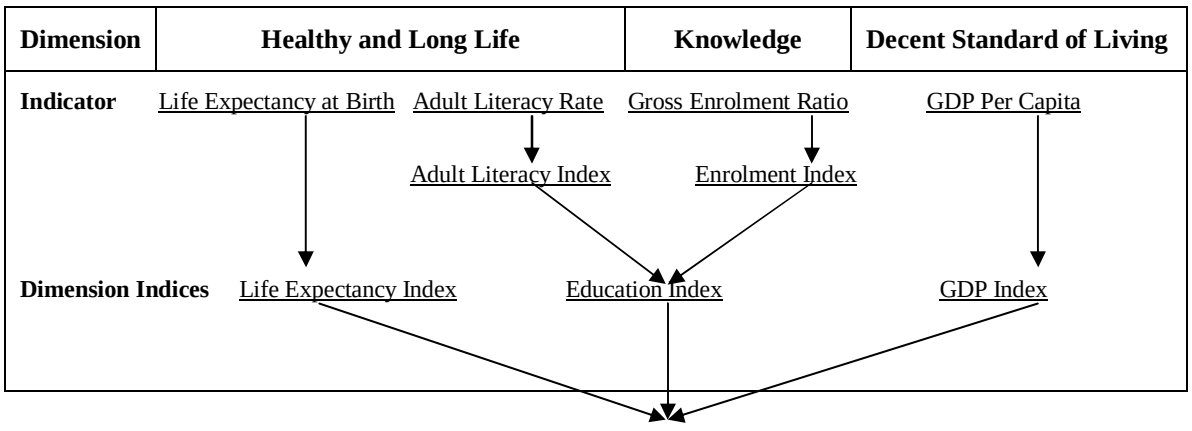
$$(11)\ldots\ldots\ldots\ldots\ldots\ldots = -e^{-\gamma y} \text{ where } \gamma > 0$$
$$= -y^{-\beta} e^{\gamma y} \text{ where } \beta \geq 0 \text{ and } \gamma \geq 0$$

In the first part of function (11), γy is the elasticity of the function, which is a positive function of income and therefore increases linearly with the increase in income. The second part is a more general class, which combines the constant absolute inequality aversion and constant relative inequality aversion forms.

Chaubey provided an alternative to these formulations, which made the use of the idea of poverty line and followed the principle of diminishing marginal returns to income:

$$(12)\ldots\ldots\ldots\ldots\ldots W = Y \text{ for } Y \leq Y^*$$
$$= Y^* + Y^* \left\{ Log\left(\frac{Y}{Y^*} \right) \right\} \text{ for } Y \geq Y^*$$

The diagram given below offers a clear overview of how the *HDI* is constructed:



Human Development Index

Construction of Indices in UNDP Report

$Life\ Expectancy\ Index\ (LEI)$: The life expectancy index measures the relative achievement of a country in life expectancy at birth. The life expectancy index of India having life expectancy of 63.6 years at birth for the year 2004 is calculated to be 0.643 as shown below:

$$(i).....LEI = \frac{63.6 - 25}{85 - 25} = 0.643$$

$Education\ Index\ (EI)$: The education index measures a country's relative achievement in both adult literacy and combined primary, secondary and tertiary gross enrolment. First, an adult literacy index (ALE) and gross enrolment index (GEI) are calculated. Then these two indices are combined to create the education index (EI), with two-thirds weight given to adult literacy and one-third weight to combined gross enrolment. For India with an adult literacy rate of 61.0 per cent and a combined enrolment ratio of 62.0 per cent in 2004, the education index is calculated to be 0.613 as shown below:

$$(iia).....ALI = \frac{61.0 - 0}{100 - 0} = 0.610$$

$$(iib).....GEI = \frac{62.0 - 0}{100 - 0} = 0.620 \backslash\backslash\backslash$$

$$(ii).....EI = \tfrac{2}{3}(ALI) + \tfrac{1}{3}(GEI) = \tfrac{2}{3}(0.610) + \tfrac{1}{3}(0.620) = 0.613$$

$GDP\ Index\ (GDPI)$: The *GDP* index is calculated using adjusted *GDP* per capita $(PPP\ US\$)$. In the *HDI* income serves as a surrogate for all the dimensions of human development not reflected in a long and healthy life and in knowledge. Income is adjusted because achieving a respectable level of human development does not require unlimited income. Accordingly, the logarithm of income is used. For India with a *GDP* per capita of *PPP* $3139 in 2004, the *GDP* index is worked out to be 0.575 as shown below:

$$(iii).....GDPI = \frac{Log(3139) - Log(100)}{Log(40000) - Log(100)} = 0.575$$

Human Development Index (HDI): Once the individual indices are calculated determining the HDI is straightforward. It is a simple average of Life Expectancy Index (LEI), Education Index (EI) and GDP Index (GDPI):

$$(iv).....HDI = \tfrac{1}{3}(LEI + EI + GDPI\ )$$
$$= \tfrac{1}{3}(0.643 + 0.613 + 0.575) = 0.610$$

Measurement of Human Development: Planning Commission Method

The National Human Development Report prepared by Planning Commission of India is an attempt to map the state of human development in India (Planning Commission, 2002). A major objective of the NHDR is to bring about a certain conceptual and methodological consensus on the use of human development approach in the country in general, and the framework for identifying indicators and building composite human development indices at the State level, in particular. The work is expected to guide similar initiatives at sub-State level in future. It seeks to put together indicators and composite indices to evaluate development process in terms of 'ex-post incomes' rather than only in terms of available 'means' of 'inputs'. The report, recognizing the broad based consensus that exists on the three critical dimensions of well-being, focuses on identifying the various contextually relevant indicators on each of them. These dimensions of well-being are related to the following:

- *Longevity:* the ability to live long and healthy life;
- *Education*: the ability to read, write and acquire knowledge; and
- *Command over resources*: the ability to enjoy a decent standard of living and have a socially meaningful life.

The various indicators of these attainments and composite indices capture the process of development and the well being of the people from two perspectives. The first is the 'conglomerate perspective', which captures advances, made by the society as a whole and the second is the 'deprivation perspective' that assesses the status of the deprived in a society. Both these perspectives are needed to adequately understand the process of development in any society (NHDR 2001, p.10).

A composite index of diverse indicators, though it is conceptually and methodologically difficult to put together, has been considered as a useful tool in policy planning in India. It is believed to help in facilitating comparisons with other composite measures. It is expected to help in a meaningful comparison of the human development

status across the States. It is, therefore, felt necessary to have core indices that are functionally decomposable at State and sub-State levels. Keeping these points in view the NHDR included a core set of indices from among the identified indicators that reflect, in some sense, the common concerns, social values and development priorities of all the States in India which permitted a meaningful comparison of the human development status across the States. The other concern that were considered to be reflected in the indices relates to their amenability to inter-temporal and inter-spatial analyses, as well as their sensitivity to tracking developmental changes at more frequent interval of time. The latter implies, making use of such indicators that are sensitive to capturing changes, for instance, on an annual basis, as against using only those indicators that primarily capture the accumulated attainments on each of the identified dimensions of well-being that is included in the summary measure. Such a consideration is important when the objective is to have composite human development indices where frequent or yearly changes are not on account of changes only in the income variable. This is not the case with the HDI of UNDP, which is presented annually in the human development reports. In their case the yearly changes in the value of the index is mostly on account of changes in the indicators that are sensitive to tracking gradual but continuous changes in such aspect of well-being that have conventionally been captured, largely, through the slow moving indicators like life expectancy at birth or even literacy rates.

While taking note of the social valuation and development priorities of India, the scaling and weighting of diverse indicators into a composite index has been done keeping in view the objectives for which the composite indices are being built. In scaling the diverse indicators, the main consideration has been to make attainments on each of them comparable and at the same time ensuring that the selection of end points, i.e. the maximum and the minimum values on the scale for each indicator are such that they support inter-temporal comparison for a reasonable period of time starting from 1980. The scaling norms that have been selected are expected to remain valid at least till 2020, at a reasonably improved pace of human development. While selecting the norms, the attainments of the best performing State on the concerned indicators and the comparable international norms are also kept in mind.

The issue of weights to combine the identified indicators on each of the three dimensions of well-being is of course debatable. The report has adopted a predominantly normative approach, as against a purely empirical basis of deriving weights to club

different indicators. Conceptually, there are good reasons to suggest that different aspects of well-being have to be co-realizable for an individual to have a meaningful sense of well-being in today's context. It follows that attainments on each aspect of well-being are equally important and hence should be equally weighted. Thus both in HDI as well as in HPI composite measures reflecting health, educational and economic attainments/deprivation have been equally weighted. However, within the composite measure on educational and health attainment, based on a sensitivity analysis, indicators with somewhat distinct attributes have been clubbed using unequal weights so as to reflect appropriately the country's context, development priorities and the desired policy focus. Accordingly, in case of the composite index on health attainment, life expectancy has been given a 65 per cent weight as against only 35 per cent for infant mortality rate. Similarly, in case of the composite index on educational attainment, while literacy rate has been given a weight of 35 per cent, the indicator capturing intensity of formal education (based on current enrolment rates in successive classes at school level) has been assigned 65 percent. In case of indicator on economic attainment namely, inequality adjusted per capita consumption expenditure, an adjustment for inflation over the period had been made to make it amenable to inter-temporal and inter-spatial comparisons. As a result, the composite indices are capable of tracking development across the States and over the period of time for which they have been estimated.

INDICATORS OF HDI IN UNDP AND NATIONAL HUMAN DEVELOPMENT REPORTS		
Attainments	UNDP Indicators	NHDR Indicators
Health	Life expectancy at birth	(1) Life Expectancy at Age 1 & (2) Infant Mortality Rate
Educational	Adult literacy rate combined with enrolment ratio	(1) Literacy Rate 7 + & (2) Intensity of Formal Education
Economic	Real GDP per capita in PPP$	Per capita real consumption expenditure adjusted for inequality

The formula used for constructing human development index in the NHDR is as follows:

$$(13)\ldots\ldots\ldots\ldots HDI_j = \tfrac{1}{3}\sum_{i=1}^{3} X_i \quad where\ X_i = \frac{X_{ij} - X_i^*}{X_i^{**} - X_i^*}$$

In the above equation *HDI* is measured for the j^{th} State where X_{ij} refers to attainment of the j^{th} State on the i^{th} indicator, X_i^{**} and X_i^* are the scaling maximum and minimum

norms, X_1 refers to expenditure index based on inflation and inequality adjusted per capita consumption expenditure, X_2 is the composite index on educational attainment $(X_2 = 0.35E_1 + 0.65E_2)$ where E_1 is literacy index based on literacy rate for the age group 7 years and above and E_2 is formal education index based on adjusted intensity of formal education and X_3 refers to composite index on health attainment $(X_3 = 0.65H_1 + 0.35H_2)$ where H_1 is life expectancy index based on life expectancy at age one and H_2 is infant mortality index based on infant mortality rate. In case of IMR the reciprocal of the indicator is used.

The different indicators included in the development radars have been scaled and normalized to take a value on a scale ranging from 0 to 5. "As a result, on each indicator including the IMR and poverty ratio, where the reciprocal of the indicator has been used, and the scaled least achievement corresponds to 0 whereas the best achievement is closer to 5. In undertaking the said scaling procedure, desirable norms had to be adopted for the chosen indicators'' (NHDR 2002, p.133). In some cases the norms are self selecting, as for instance, is the case with access to safe drinking water or literacy rate and in some others like per capita consumption expenditure or even infant mortality rate, there is an element of value judgment. In case of the inflation adjusted per capita consumption expenditure (at 1983 prices) the maximum has been pegged at Rs. 500 per capita per month. For poverty the minimum has been kept at 5 per cent such that it corresponds to a value of 5 on a scale of 0.5 on the radar. In all other cases the scaling norms are as follows:

DIMENSION INDICES		
Indicators	**Scaling Norms for HDI**	
	Maximum	**Minimum**
Life expectancy at age 1 (years)	80	50
Infant mortality rate	-	20 per 1000
Literacy rate for 7+ years	100	0
Adjusted intensity of formal education (Estimated)	7	0
Per capita monthly consumption expenditure (Rs.)	325	65

Source: NHDR 2001, Planning Commission, New Delhi

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