Technical notes

based on Human Development Report 2001

The human development index (HDI)

There are two HDIs computed for this report: HDI-1for inter-provincial comparisons and HDI-2 for purposes of comparing provinces with other countries. The HDIs are computed based on three indicators, namely, longevity, knowledge, and standard of living. These are measured respectively by life expectancy at birth; the basic enrolment ratio (or enrolment ratio of children 7 to 16 years old), the high-school graduate ratio, and the functional literacy rate; and real income per capita.

Before the HDI itself is calculated, an index needs to be created for each of these dimensions. To calculate these dimension indices — the life expectancy, education, and income indices — minimum and maximum values (goalposts) are chosen for each underlying indicator.

Performance in each dimension is expressed as a value between 0 and 1 by applying the following general formula:

$$\text{Dimension index} = \frac{\text{actual value - minimum value}}{\text{maximum value - minimum value}}$$

The HDI is then calculated as a simple average of the dimension indices. Below, we illustrate the calculation of the HDI for a sample province.

Goalposts for calculating the HDI

Indicator	Maximum value	Minimum value
Life expectancy at birth (years)	85	25
Basic enrolment ratio (%)	100	0
High school graduate ratio (%) [for HDI-1]	100	0
Functional literacy rate [for HDI-2]	100	0
Real per capita income (Pesos) [for HDI-1]	52,704 (NCR per capita income 1997)	7,850 (Sulu per capita income 2000)
Real per capita income (PPP US$) [for HDI-2]	40,000	100

Calculating the HDI

The illustration of the calculation of the HDI uses data for Rizal.

1. Calculating the life expectancy index

The life expectancy index measures the relative achievement of a country in life expectancy at birth. To obtain the life expectancy figures for this report, a straight-line regression was done using the gender-differentiated life expectancy figures for 1970, 1980, 1990, and 1995 obtained from Flieger and Cabigon (1994 and 1999), and this was projected to 1997 and 2000. The life expectancy in a province is assumed to be just the simple average of the male and the female life expectancies. For Rizal, with an estimated life expectancy of 70.2 in 2000, the life expectancy index is 0.753.

$$\text{Life expectancy index} = \frac{70.2 - 25}{85 - 25} = 0.753$$

2. Calculating the education index

The education index measures a country's relative achievement in education. For HDI-1, first, an index for the basic enrolment ratio and the high-school graduate ratio are calculated. Then the simple average of these two indices is computed to create the education index. For HDI-2, the functional literacy rate replaces the high-school graduate ratio in the above computation. For Rizal, with a basic enrolment rate of 94.2 percent, a high-school graduate ratio of 0.669, and functional literacy of 0.892, Education Index -1 (for HDI-1) is 0.805 and Education Index -2 (for HDI-2) is 0.917.

$$\text{Basic enrolment index} = \frac{94.2 - 0}{100 - 0} = 0.942$$

$$\text{High school graduate index} = \frac{66.9 - 0}{100 - 0} = 0.669$$

$$\text{Functional literacy index} = \frac{89.2 - 0}{100 - 0} = 0.892$$

Education Index -1 = ½ (Basic enrolment index) + ½ (High school graduate index)

Education Index -1 = ½ (Basic enrolment index) + ½ (High school graduate index)
= ½ (0.942) + ½ (0.669)
= 0.805

Education Index -2 = ½ (Basic enrolment index) + ½ (Functional literacy index)
= ½ (0.942) + ½ (0.892)
= 0.917

3. Calculating the real per capita income index

The Income Index is calculated using adjusted per capita income figures obtained from the Family Income and Expenditures Survey. 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.

To compute for Income Index-1 (for HDI-1), the per capita income figures are first deflated to 1997 prices using the National Statistics Office's regional consumer price indices to make them consistent over time, and then adjusted further using the provincial cost-of-living indices derived by Balisacan (2000) to make them consistent across space.

To compute for Income Index-2 (for HDI-2), the (unadjusted) per capita income figures are first converted to US currency using the average peso-dollar exchange rate for the year. This is then converted to purchasing power parity US$ using the exchange rate implicit in the 2001 *Human Development Report*. The Income index-2 is based on a scale defined by a minimum income of PPPUS$100 and a maximum of PPPUS$40,000. First, the gap between a province's PPPUS$ income and the minimum income of PPPUS$100 is computed as the difference between their logarithms. This difference is then taken as a proportion of the gap between the maximum income of PPPUS$, and the minimum income of PPPUS$100, again taken as the difference between their logarithms.

For Rizal,with a real per capita income in pesos of 39,895 (for provincial comparisons) and in PPPUS$ of 4,190 (for comparison with other countries), Income Index-1 is 0.714 and Income Index-2 is 0.623.

$$\text{Income index - 1} = \frac{39{,}895 - 52{,}704}{52{,}704 - 7{,}850} = 0.714$$

$$\text{Income index - 2} = \frac{\log(4{,}190) - \log(100)}{\log(40{,}000) - \log(100)} = 0.623$$

4. Calculating the HDI

Once the dimension indices have been calculated, determining the HDI is straightforward. It is the simple average of the three dimension indices.

HDI-1 = 1/3 (life expectancy index) + 1/3 (education index-1) + 1/3 (income index-1)
= 1/3 (0.753) + 1/3 (0.805) + 1/3 (0.714)
= 0.758

HDI-2 = 1/3 (life expectancy index) + 1/3 (education index-2) + 1/3 (income index-2)
= 1/3 (0.753) + 1/3 (0.917) + 1/3 (0.623)
= 0.765

The gender-related development index (GDI)

While the HDI measures average achievement, the GDI adjusts the average achievement to reflect the *inequalities* between men and women in the following dimensions as the HDI. Two GDI indices are computed in these report, GDI-1 and GDI-2, corresponding to HDI-1 and HDI-2.

The calculation of the GDI involves three steps. First, female and male indices in each dimension are calculated according to this general formula:

$$\text{Dimension index} = \frac{\text{actual value - minimum value}}{\text{maximum value - minimum value}}$$

Second, the female and male indices in each dimension are combined in a way that penalizes differences in achievement between men and women. The resulting index, referred to as the equally distributed index, is calculated according to this general formula:

$$\text{Equally distributed index} = \{[\text{female population share (female index}^{1-\epsilon})] + [\text{male population share (male index}^{1-\epsilon})]\}^{1/1-\epsilon}$$

ϵ measures the aversion to inequality. In the GDI $\epsilon = 2$. Thus the general equaltion becomes:

$$\text{Equally distributed index} = \{[\text{female population share (female index}^{-1})] + [\text{male population share (male index}^{-1})]\}^{-1}$$

which gives the harmonic mean of the female and male indices.

Third, the GDI is calculated by combining the three equally distributed indices in an unweighted average.

Goalposts for calculating the GDI

Indicator	Maximum value	Minimum value
Female life expectancy at birth (years)	87.5	27.5
Male life expectancy at birth (years)	82.5	22.5
Basic enrolment ratio (%)	100	0
High school graduate ratio (%) for GDI-1	100	0
Functional literacy rate for GDI-2	100	0
Estimated earned income (Pesos) for GDI-1	67,933 (NCR male estimated earned income 1997)	5,000*
Estimated earned income (PPP US$) for GDI-2	40,000	100

*somewhat arbitrary and simply chosen so as to be less than value for minimum income province, to ensure that GDI-1 is defined for all provinces.

Calculating the GDI

The illustration of the calculation of the GDI uses data for Rizal.

1. Calculating the equally distributed life expectancy index

The first step is to calculate separate indices for female and male achievements in life expectancy, using the general formula for dimension indices.

FEMALE

Life expectancy: 73.6 years

$$\text{Life expectancy} = \frac{73.6 - 27.5}{87.5 - 27.5} = 0.768$$

MALE

Life expectancy: 66.9 years

$$\text{Life expectancy} = \frac{66.9 - 22.5}{82.5 - 22.5} = 0.739$$

Next, the female and male indices are combined to create the equally distributed life expectancy index, using the general formula for equally distributed indices. The male and female population shares are obtained from the 2000 Labor Force Surveys.

FEMALE

Population share: 0.499

Life expectancy index: 0.768

MALE

Population share: 0.501

Life expectancy index: 0.739

$$\text{Equally distributed life expectancy index} = \{[0.499\ (0.768^{-1})] + [0.501\ (0.739^{-1})]\}^{-1} = 0.753$$

2. Calculating the equally distributed education index

First, indices for the basic enrolment rate, the high-school graduate ratio, and the functional literacy rate are calculated separately for females and males. Calculating these indices is straightforward, since the indicators used are already normalized between 0 and 100.

FEMALE
- Basic enrolment rate: 96.3
- Basic enrolment index: 0.963
- High-school graduate ratio: 66.0
- High-school graduate index: 0.660
- Functional literacy rate: 90.6
- Functional literacy index: 0.906

MALE
- Basic enrolment rate: 92.3
- Basic enrolment index: 0.923
- High-school graduate ratio: 67.8
- High-school graduate index: 0.678
- Functional literacy rate: 87.6
- Functional literacy index: 0.876

Second, the education indices are computed separately for females and males.

Female education index-1= ½ (0.963) + ½ (0.660) = 0.812

Male education index-1= ½ (0.923) + ½ (0.678) = 0.800

Female education index-2= ½ (0.963) + ½ (0.906) = 0.935

Male education index-2= ½ (0.923) + ½ (0.876) = 0.900

Finally, the female and male education indices are combined to create the equally distributed education index:

FEMALE
- Population share: 0.499
- Education index-1: 0.812
- Education index-2: 0.935

MALE
- Population share: 0.501
- Education index-1: 0.800
- Education index-2: 0.900

Equally distributed education index-1 = $\{[0.499\ (0.812^{-1})] + [0.501\ (0.800^{-1})]\}^{-1}$ = **0.806**

Equally distributed education index-2 = $\{[0.499\ (0.935^{-1})] + [0.501\ (0.900^{-1})]\}^{-1}$ = **0.917**

3. Calculating the equally distributed income index

First, female and male earned income are estimated. This is done by calculating the female and male shares in total income (from 1999 APIS) and then multiplying these by the real per capita income figures in the HDI table. As there are two income figures (one for provincial and another for international comparisons), there are also two equally distributed income indices. The income indices are calculated for each gender.

FEMALE

$$\text{Income index -1} = \frac{29{,}970 - 67{,}933}{67{,}933 - 5{,}000} = 0.397$$

$$\text{Income index - 2} = \frac{\log(3{,}148) - \log(100)}{\log(40{,}000) - \log(100)} = 0.576$$

MALE

$$\text{Income index -1} = \frac{39{,}895 - 67{,}933}{67{,}933 - 5{,}000} = 0.712$$

$$\text{Income index - 2} = \frac{\log(5{,}231) - \log(100)}{\log(40{,}000) - \log(100)} = 0.660$$

Second, the female and male income indices are combined to create the equally distributed income index:

FEMALE
- Population share: 0.499
- Income index-1: 0.397
- Income index-2: 0.576

MALE
- Population share: 0.501
- Income index-1: 0.712
- Income index-2: 0.660

$$\text{Equally distributed income index-1} = \{[0.499\,(0.397^{-1})] + [0.501\,(0.712^{-1})]\}^{-1} = \mathbf{0.510}$$

$$\text{Equally distributed income index-2} = \{[0.499\,(0.576^{-1})] + [0.501\,(0.660^{-1})]\}^{-1} = \mathbf{0.615}$$

4. Calculating the GDIs

Calculating the GDI is straightforward. It is simply the unweighted average of the three component indices — the equally distributed life expectancy index, the equally distributed education index and the equally distributed income index.

$$\begin{aligned}\text{GDI-1} &= 1/3\ (\text{life expectancy index}) + 1/3\ (\text{education index-1}) + 1/3\ (\text{income index-1})\\ &= 1/3\ (0.753) + 1/3\ (0.806) + 1/3\ (0.510)\\ &= 0.690\end{aligned}$$

$$\begin{aligned}\text{GDI-2} &= 1/3\ (\text{life expectancy index}) + 1/3\ (\text{education index-2}) + 1/3\ (\text{income index-2})\\ &= 1/3\ (0.753) + 1/3\ (0.917) + 1/3\ (0.615)\\ &= 0.762\end{aligned}$$

The human poverty index for developing countries (HPI)

While the HDI measures average achievement, the HPI measures *deprivation* in the three basic dimensions of human development captured in the HDI:

- A long and healthy life – vulnerability to death at a relatively early age, as measured by the probability at birth of not surviving to age 40. This was derived from the *1995 Gender-specific Life Tables for the Philippines, its Regions and Provinces* by Flieger and Cabigon.
- Knowledge – exclusion from the world of reading and communications, as measured by the functional illiteracy rate. This was obtained from the 1994 Functional Literacy and Mass Media Survey of the NSO.
- A decent standard of living – lack of access to overall economic provisioning, as measured by the percentage of the population not using improved water sources and the percentage of children under five who are underweight. These were obtained, respectively, from the 2000 FIES and the 1998 National Nutrition Survey of the Food and Nutrition Research Institute.

Calculating the HPI

The illustration of the calculation of the HPI uses data for Rizal.

1. Measuring deprivation in a decent standard of living

An unweighted average of two indicators is used to measure deprivation in a decent standard of living.

Unweighted average = ½ (population not using improved water sources)
+ ½ (underweight children under five)

For Rizal:
Population not using improved water sources = 30.9%
Unweighted children under five = 9.4%

Unweighted average = ½ (30.9) + ½ (9.4) = 20.1

2. Calculating the HPI

The formula for calculating the HPI is as follows

$$HPI = [1/3(P_1^{\alpha} + P_2^{\alpha} + P_3^{\alpha})]^{1/\alpha}$$

Where:

P_1 = Probability at birth of not surviving to age 40 (times 100)

P_2 = Functional illiteracy rate

P_3 = Unweighted average of population not using improved water sources and underweight children under age five

$\alpha = 3$

For Rizal

$P_1 = 1.3$

$P_2 = 16.8$

$P_3 = 20.1$

$$HPI = [1/3\ (11.3^3 + 10.8^3 + 20.1^3)]^{1/3} = 15.4$$