

The background image is a photograph of a rural village scene, overlaid with a semi-transparent dark green filter. In the foreground, there is a traditional house with a steeply pitched thatched roof and a small porch. To the left of this house, a tall, slender antenna tower stands prominently. In the background, other similar houses are visible on a slight rise, and more antenna towers can be seen against a hazy sky. The overall atmosphere is quiet and rural.

# 01X-Human Development Index Supplementary Slides

*Off-Grid Electrical Systems in Developing Countries*

# Discussion

What are the characteristics of a “good life”?

How do you quantify “human development”?

# Human Development Index (HDI)

- HDI was developed by the United Nations as a way of numerically evaluating the well-being of a country
- Considers three equally-weighted dimensions
  - Standard of Living (Income)
  - Knowledge (Education)
  - Long and Healthy Life (Life Expectancy)
- 1.0 is the maximum reasonable HDI score
  - HDI is not theoretically limited to 1.0

# HDI: Indicators

## 1. Knowledge

- Mean years of schooling
- Expected years of schooling



Equally weighted

## 2. Standard of Living

- Per capita Gross National Income (GNI in \$PPP/person)

## 3. Long and Healthy Life

- Life expectancy at birth

Expected years of schooling: Number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life.

# Calculating HDI

- LEI (Life Expectancy Index):

- LE: life expectancy at birth

$$LEI = \frac{LE - 20}{85 - 20}$$

- EI (Education Index):

- MYS: mean years of school
- EYS: expected years of school

$$EI = \frac{1}{2} \frac{MYS}{15} + \frac{1}{2} \frac{EYS}{18}$$

Equal weighting

- II (Income Index):

- GNI: per capita GNI in PPP\$

$$II = \frac{\ln(GNI) - \ln(100)}{\ln(75000) - \ln(100)}$$

$$HDI = \sqrt[3]{LEI \times EI \times II}$$

Geometric mean

Note: HDI was calculated differently prior to 2009, and will be adjusted in the future.

# Calculating HDI

Constants in the equations (other than the  $\frac{1}{2}$  in the EI) represent the estimated maximum or minimum value for the indicator

- Used in normalization, making it highly unlikely for a score to exceed 1.0

$$LEI = \frac{LE - 20}{85 - 20}$$

Maximum life expectancy

Minimum life expectancy

# Calculating HDI

- Income Index is logarithmic—increasing GNI has diminishing returns on the II score

$$II = \frac{\ln(GNI) - \ln(100)}{\ln(75000) - \ln(100)}$$

- Justification: increasing GNI from \$300 to \$400 is more significant than increasing from \$50,000 to \$50,100

# Exercise

A GNI of \$300 results in an II of 0.166; a GNI of \$400 results in an II of 0.209.

Compute and compare the II for GNI of \$50,000 and \$50,100.



# Exercise

A GNI of \$300 results in an II of 0.166; a GNI of \$400 results in an II of 0.209.

Compute and compare the II for GNI of \$50,000 and \$50,100.

$$II = \frac{\ln(50000) - \ln(100)}{\ln(75000) - \ln(100)} = 0.9388$$

$$II = \frac{\ln(50100) - \ln(100)}{\ln(75000) - \ln(100)} = 0.9391$$

II is capped at 1.0 if GNI is greater than \$75,000?

# Example

Ethiopia's 2014 HDI indicators are: life expectancy at birth (64.1), expected years of school (8.5), mean years of schooling (2.4), GNI (PPP\$1428). What is the HDI?

<http://www.hdr.undp.org/en/composite/HDI>

# Example

- Start by computing the Life Expectancy Index score:

$$LEI = \frac{LE - 20}{85 - 20} = \frac{64.1 - 20}{85 - 20} = 0.6785$$

- Now the Income Index score:

$$II = \frac{\ln(GNI) - \ln(100)}{\ln(75000) - \ln(100)} = \frac{\ln(1428) - \ln(100)}{\ln(75000) - \ln(100)} = 0.4016$$

# Example

- Start by computing the Education Index score:

$$EI = \frac{1}{2} \frac{MYS}{15} + \frac{1}{2} \frac{EYS}{18} = \frac{1}{2} \frac{2.4}{15} + \frac{1}{2} \frac{8.5}{18} = 0.3161$$

- Now compute the geometric mean:

$$HDI = \sqrt[3]{LEI \times EI \times II} = \sqrt[3]{0.6785 \times 0.3161 \times 0.4016} = 0.4416$$

Ethiopia ranks 174 out of 188 in the world

# Exercise

Canada's 2014 HDI indicators are: life expectancy at birth (82.0), expected years of school (15.9), mean years of schooling (13.0), GNI (PPP\$42155). What is the HDI?

<http://www.hdr.undp.org/en/composite/HDI>

# Exercise

Canada's 2014 HDI indicators are: life expectancy at birth (82.0), expected years of school (15.9), mean years of schooling (13.0), GNI (PPP\$42155). What is the HDI?

LEI: 0.938

II: 0.913

EI: 0.875

HDI: 0.9134

# Other Indices

- Inequality adjusted HDI: adjusts the three HDI scores by the distribution of the indicators across the population (if no inequality, then it is the same as the HDI)
- Gender HDI: measures the gender gap by comparing female HDI to male HDI in a country
- See also:
  - Multidimensional Poverty Index
  - Sustainable Economic Development Assessment

# Contact Information

Henry Louie, PhD

Associate Professor

Fr. Wood Endowed Research Chair

Seattle University



@henrylouie

[hlouie@ieee.org](mailto:hlouie@ieee.org)

Office: +1-206-398-4619