TRAINING MATERIAL FOR PRODUCING NATIONAL HUMAN DEVELOPMENT REPORTS

The Multidimensional Poverty Index (MPI)

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Purpose: To measure acute poverty: the proportion of people who experience multiple deprivations **and** the intensity of such deprivations.

Components: In the version presented in the global *HDR*, ten indicators belonging to three dimensions: health, education and living standards.

Versions of the Multidimensional Poverty Index (MPI):

The MPI is a very versatile methodology that can be readily adjusted to incorporate alternative indicators, cutoffs and weights that might be appropriate in regional national, or subnational contexts. There are currently two broad categories of MPI measures:

1.   **Multidimensional Poverty Index**: This is the MPI calculated at the country level using globally comparable data. It compares the situation of countries with respect to acute poverty. In the *Human Development Report* (*HDR*) 2011, the global MPI is presented for 109 countries, together with the constituent indicators, using the method described here.

2.   **Regional or national MPIs**: These are multidimensional poverty measures that have been created by adapting (or using forms of) the method upon which the MPI is based to better address local realities, needs and the data available (these measures use the Alkire-Foster method). Their purpose is to assess multidimensional poverty levels in specific countries or regions in the components most relevant and feasible locally.

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[1] The authors are grateful to Diego Zavaleta, Joanne Tomkinson and Melissa Friedman for helpful comments and editing work. The chapter draws substantially from Alkire, A. and ME Santos (2010). Those looking for a more detailed discussion of the MPI, the selection processes involved in creating the index and the results, are strongly advised to read this paper in full, as well as Alkire and Foster (2011).

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MPI: CONTENTS

1. OVERVIEW

Poverty has traditionally been measured in one dimension, usually income or consumption (terms used interchangeably here). In this analysis, a basket of goods and services considered the minimum requirement to live a non-impoverished life is valued at the current prices. People who do not have an income sufficient to cover that basket are deemed poor.

Income poverty certainly provides very useful information. Yet poor people themselves define their poverty much more broadly to include lack of education, health, housing, empowerment, employment, personal security and more. No one indicator, such as income, is uniquely able to capture the multiple aspects that contribute to poverty (section 7 discusses income and multidimensional poverty in detail). For this reason, since 1997, *Human Development Reports* (*HDRs*) have measured poverty in ways different than traditional income-based measures. The Human Poverty Index (HPI) was the first such measure, which was replaced by the Multidimensional Poverty Index (MPI) in 2010 (section 8 elaborates on the differences between the two).

The MPI is an index designed to measure acute poverty. Acute poverty refers to two main characteristics. First, it includes people living under conditions where they do not reach **the minimum internationally agreed standards in indicators of basic functionings,**[2] such as being well nourished, being educated or drinking clean water. Second, it refers to people living under conditions where they do not reach the minimum standards in **several** aspects **at the same time**. In other words, the MPI measures those experiencing **multiple deprivations,** people who, for example, are both undernourished and do not have clean drinking water, adequate sanitation or clean fuel.

The MPI combines two key pieces of information to measure acute poverty: the **incidence** of poverty, or the proportion of people (within a given population) who experience multiple deprivations, and the **intensity** of their deprivation - the average proportion of (weighted) deprivations they experience.

Both the incidence and the intensity of these deprivations are highly relevant pieces of information for poverty measurement. To start with, the proportion of poor people is a necessary measure. It is intuitive and understandable by anyone. People always want to know how many poor people are in a society as a proportion of the whole population.

Yet, that's not enough. Imagine two countries: in both, 30 per cent of people are poor (incidence). Judged by this piece of information, these two countries are equally poor. However, imagine that in one of the two countries poor people are deprived—on average—in one-third of the dimensions, whereas in the other country, the poor are deprived—on average—in two-thirds. By combining the two pieces of information - the intensity of deprivations and the proportion of poor people - we know that these two countries are not equally poor, but rather that the second is poorer than the first because the intensity of poverty is higher.

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[2] In Amartya Sen's capability approach, **functionings** are the beings and doings that a person can achieve. For a fuller definition see box 4.

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The MPI also has other advantages. Because of its robust functional form and direct measures of acute deprivation, it allows for comparisons across countries or regions of the world, as well as within-country comparisons between regions, ethnic groups, rural and urban areas, and other key household and community characteristics. Furthermore, it enables analysis of **patterns of poverty**: how much each indicator and each dimension contributes to overall poverty.

The MPI builds on recent advances in theory and data to present the first global measure of its kind and offers a valuable complement to traditional income-based poverty measures. It was introduced for the first time in the 2010 *HDR*. In 2011, it covered 109 countries with a combined population of 5.5 billion (79% of the world total). For the very latest data on the numbers of countries covered and total population, please visit the HDR website: http://hdr.undp.org/en/statistics/mpi/.

2. COMPONENTS OF THE GLOBAL MPI

The MPI is composed of three dimensions made up of ten indicators (figure 1). Associated with each indicator is a minimum level of satisfaction, which is based on international consensus (such as the Millennium Development Goals or MDGs). This minimum level of satisfaction is called a **deprivation cut-off**. Two steps are then followed to calculate the MPI:

Step 1: Each person is assessed based on household achievements to determine if he/she is below the deprivation cut-off in each indicator. People below the cut-off are considered deprived in that indicator.

Step 2: The deprivation of each person is weighted by the indicator's weight (an explanation on weighting can be found in section 3). If the sum of the weighted deprivations is 33 per cent or more of possible deprivations, the person is considered to be multidimensionally poor.

Figure 1. Composition of the MPI – dimensions and indicators
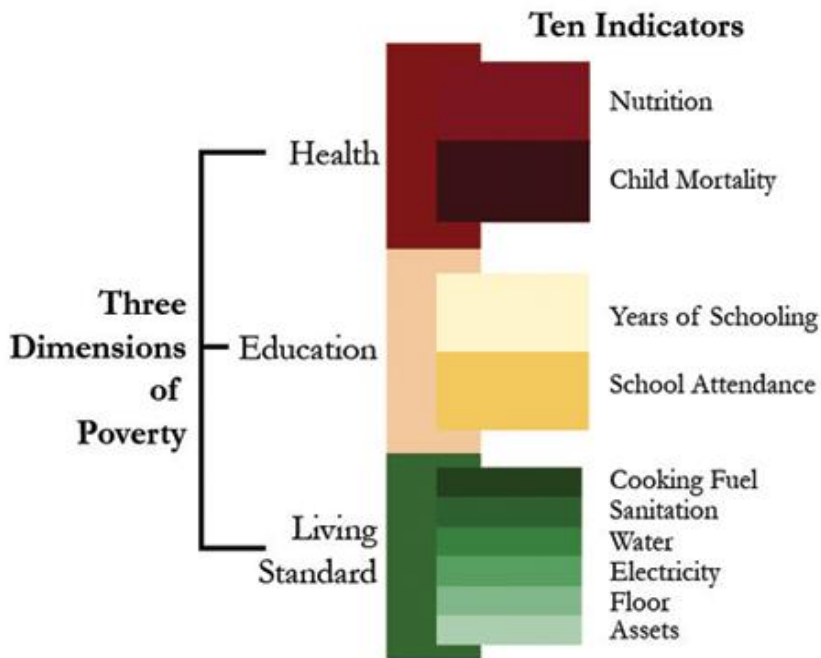
The MPI has ten indicators: two for health, two for education and six for living standards. The indicators of the MPI were selected after a thorough consultation process involving experts in all three dimensions. During this process, the ideal choices of indicators had to be reconciled with what was actually possible in terms of data availability and cross-country comparison. The ten indicators finally selected are almost the only set of indicators that could be used to compare around 100 countries (section 8 explores these data limitations further).

Ideally, the MPI would be able to make comparisons across gender and age groups, for example, along with documentation of intra-household inequalities. Yet because certain variables are not observed for all household members this was not possible. So each person is identified as deprived or not deprived using any available information for household members. For example, if any household member for whom data exists is malnourished, each person in that household is considered deprived in nutrition. Taking this approach – which was required by the data – does not reveal intra-household disparities, but it is intuitive and assumes shared positive (or negative) effects of achieving (or not achieving) certain outcomes.

Box 1 provides a summary of the dimensions, indicators, thresholds and weights used in the MPI. Such selections are further explained below, along with some alternatives.

BOX 1   INSIDE THE MPI - DIMENSIONS, INDICATORS' THRESHOLDS AND WEIGHTS

1. Education (each indicator is weighted equally at 1/6)

> **Years of Schooling**: deprived if no household member has completed five years of schooling

> **School Attendance**: deprived if any school-age child is not attending school in years 1 to 8

2. Health (each indicator is weighted equally at 1/6)

> **Child Mortality**: deprived if any child has died in the family

> **Nutrition**: deprived if any adult or child for whom there is nutritional information is malnourished

3. Living standards (each indicator is weighted equally at 1/18)

> **Electricity**: deprived if the household has no electricity

> **Drinking Water**: deprived if the household does not have access to clean drinking water or clean water is more than 30 minutes walk from home (roundtrip)

> **Sanitation**: deprived if the household lacks adequate sanitation or if their toilet is shared

> **Flooring**: deprived if the household has a dirt, sand or dung floor

> **Cooking Fuel**: deprived if the household cooks with wood, charcoal or dung

> **Asset ownership**: deprived if the household does not own more than one of: radio, TV, telephone, bicycle, motorcycle, or refrigerator; and does not own a car or tractor

2.1 Education

The MPI uses two indicators that complement each other within the education dimension: one looks at completed years of schooling of household members, the other at whether children are attending school. Years of schooling acts as a proxy for the level of knowledge and understanding of household members. Note that both years of schooling and school attendance are imperfect proxies. They do not capture the quality of schooling, the level of knowledge attained or skills. Yet both are robust indicators, are widely available, and provide the closest feasible approximation to levels of education for household members.

In terms of deprivation cut-offs for this dimension, the MPI requires that at least one person in the household has completed **five years** of schooling and that **all children of school age** are attending grades 1 to 8 of school.

It is important to note that because of the nature of the MPI indicators, someone living in a household where there is at least one member with five years of schooling is considered non-deprived, even though she may not be educated. Analogously, someone living in a household where

there is at least one child not attending school is considered deprived in this indicator, even though she may have completed schooling. People living in households with no school-aged children are considered non-deprived in school attendance. Hence the incidence of deprivation in this indicator will reflect the demographic structure of the household and country, as well as the educational attainments.

2.2 Health

Comparable indicators of health for all household members are generally missing from household surveys, making this dimension the most difficult to measure. The MPI uses two health indicators that, although related, depart significantly from standard health indicators.

The first indicator looks at nutrition of household members. For children, malnutrition can have life-long effects in terms of cognitive and physical development. Adults or children who are malnourished are also susceptible to other health disorders; they are less able to learn and to concentrate and may not perform as well at work. Data from the Demographic and Health Surveys (DHS) usually provides nutritional information on children and women of reproductive age. Multiple Indicator Cluster Surveys (MICS) provide nutritional information on children, and World Health Survey (WHS) data provides nutritional information on adult household members (men or women). The nutritional indicator used for children relates to being under-weight (also called weight-for-age), which is used to track the MDGs. A child is under-weight if she is two or more standard deviations below the median of the reference population. The nutritional indicator used for adults meanwhile is the Body Mass Index (BMI). An adult is considered to be undernourished if he or she has a BMI lower than 18.5. The international MPI does not consider children or adults that are overweight as deprived in nutrition.

The MPI identifies a person as deprived in nutrition if anyone in their household (for whomever there is information on—children, women or other adults) is malnourished. Therefore, it is fundamental to note that deprivation rates by indicator depart from the standard nutritional statistics, and depend upon the survey used and the demographic structure of the household.

The second indicator uses data on child mortality. Most, although not all, child deaths are preventable, being caused by infectious disease or diarrhoea. Child malnutrition also contributes to child death. In the MPI each household member is considered to be deprived if there has been at least one observed child death (of any age) in the household. It is important to observe that this indicator differs from the standard mortality statistics. Differences between MPI indicators and other standard indicators are further explained in section 3.

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2.3 Living standards

The MPI considers six indicators for standards of living. It includes three standard MDG indicators that are related to health and living standards, and which particularly affect women: access to clean drinking water, access to improved sanitation, and the use of clean cooking fuel. The justification for these indicators is adequately presented in the MDG literature. It also includes two non-MDG indicators: access to electricity and flooring material. Both of these provide some rudimentary indication of the quality of housing for the household. The final indicator covers the ownership of some consumer goods, each of which has a literature surrounding them: radio, television, telephone, bicycle, motorbike, car, truck and refrigerator.

The selected deprivation cut-offs for each indicator (except for the one relating to assets) are backed by international consensus as they follow the MDG indicators as closely as data permit.

Water: A person has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within a distance of 30 minutes' walk (roundtrip). If it fails to satisfy these conditions, then the household is considered deprived in access to water.[3]

Improved sanitation: A person is considered to have access to improved sanitation if the household has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared. If the household does not satisfy these conditions, then it is considered deprived in sanitation.

Electricity: A person is considered to be deprived here if it does not have access to electricity.

Flooring: Flooring material made of dirt, sand or dung counts as deprivation in flooring.

Cooking fuel: A person is considered deprived in cooking fuel if the household cooks with dung, charcoal or wood.

Assets: If a household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator, and does not own a car or tractor then each person in it is considered deprived.[4]

Clearly, all the living standard indicators are means rather than ends; they are not direct measures of functionings. Yet, they have two strengths. In the first place, they are very closely connected to the end (or the functionings) they are supposed to facilitate. Second, most of the indicators are related to the MDGs, which provide stronger grounds for their inclusion in our index.

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[3] Following the MDGs, improved water sources do not include vendor-provided water, bottled water, tanker trucks or unprotected wells and springs.

[4] Note that the "asset index" of the MPI is exactly the same for all countries. It is not based on principal components analysis (PCA) as other asset indices are (such as the DHS Wealth Index) because if such a procedure were used, (a) it would require a relative cut-off rather than an absolute cut-off for the asset index, which would be inconsistent with the rest of the measure; (b) it would not be comparable across countries or across time, because the PCA would weight each component differently in each survey. Prices could not be used to construct the asset index as the surveys lack information on the price, quality or age of assets.

2.4 Sensitivity of indicators

Most of the ten indicators are relatively sensitive to policy change and measure "flow" (changes per unit of time, see section 8 on limitations for an explanation of stock and flow indicators), which means they will reflect changes in-country with as little as one year between surveys. However, the mortality indicator and years of schooling indicators may change relatively more slowly than others.

2.5 Data sources

The MPI relies on three main datasets that are publicly available and comparable for most developing countries:

- The Demographic and Health Surveys
  http://www.measuredhs.com/aboutsurveys/dhs/start.cfm
- The Multiple Indicators Cluster Survey http://www.childinfo.org/mics.html
- The World Health Survey http://www.who.int/healthinfo/survey/en/

In the countries in which none of these internationally comparable surveys was available, country specific surveys that contained information on the MPI indicators were used; in 2010 for example, special surveys were used for Mexico and for urban Argentina.

3. MEASUREMENT

As stated in section 1, the MPI is an index designed to measure acute poverty. However, because it follows the Alkire and Foster (2007, 2011) methodology, it has a flexible structure which can be adapted to other specifications. Here we will explain the methodology step-by-step, as if you were to design a national multidimensional poverty measure, but will specify the particular case of the MPI.

3.1 Methodology step-by-step

Step 1: Defining the data source

The first fundamental requirement for any MPI (global, regional, national or sub-national) is that all the information for the individual or household must come from the same survey. This is to determine whether a person is deprived in a number of things **altogether**. Thus, one cannot collect indicators from different data sources - for example, one cannot use health data from one source, and education data from another (as is done for the HDI, the IHDI, the GII and other measures).

If you are designing a national multidimensional poverty measure you will need to decide which data source best allows you to measure poverty. This selection is obviously linked to Step 2 and 3. It is also worth noting that, for cross country comparability, surveys must contain indicators with comparable definitions. This has been the premise when selecting the surveys used to estimate the MPI.

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Step 2: Choosing the unit of analysis

As already explained, the global MPI identifies an individual as deprived based on household achievements so the unit of analysis is the household because internationally comparable surveys do not have individual-level information for the ten indicators in the MPI (in particular, the health indicators are the most problematic for individual-level data). However, when designing a national measure, it may be the case that a local survey collects individual-level data for all the indicators of interest, in which case the unit of analysis can be the individual.

Step 3: Choosing the dimensions and indicators

The MPI uses ten indicators belonging to three dimensions which mirror the HDI. Their intrinsic and instrumental value has been well discussed. When designing a national multidimensional poverty measure, the selection of dimensions and indicators is a key step.

There is no fixed list of what should be included, and the MPI does not intend to constitute one. The list is open, and the most important thing is the process through which it is selected. It must be agreed upon with a certain degree of consensus. Such a consensus may derive from different sources, including participatory experiments, a legal basis, international agreements such as the MDGs or human rights, and empirical evidence regarding people's values. Statistical relationships between variables must also be explored and understood. For further discussion on the selection of dimensions see Alkire (2008) and for real-world examples, see box 2.

Step 4: Choosing the indicators' deprivation cut-offs

The MPI and any multidimensional poverty measure of its type requires a deprivation cut-off for each indicator. Usually, the indicators' deprivation cut-offs are noted as z_i, so that person i is considered deprived if her achievement in that indicator x_i is below the cut-off, that is, if $x_i < z_i$.

Clearly, well-founded reasons are needed to determine each cut-off. In the case of the MPI, most of the deprivation cut-offs are based on the internationally agreed upon MDG standards. When designing a national measure, different cut-offs may be set based on current policy priorities in the country and what is considered to be non-deprived according to the culture. Empirical evidence and previous practices must be considered. Section 2 explained the global MPI's cut-offs in detail, and section 4 details the alternative specifications to consider for national measures.

Step 5: Choosing the indicators' weights

Once the indicators and their corresponding cut-offs have been selected, the next step is to define the weights each indicator will have in the measure. In the MPI the three dimensions are equally weighted, so that each of them receives a 1/3 weight. The indicators within each dimension are also equally weighted. Thus, each indicator within the health and education dimension receives a 1/6 weight and each indicator within the living standards dimension receives a 1/18 weight (1/3 ÷ 6).[5] If

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[5] If there are fewer than 10 indicators, the same weighting principle applies. For example, suppose there is a country whose dataset is missing one of the living standard indicators (i.e. no information was collected on that variable). Thus, the total number of indicators is nine in this case. Then each of the four health and education indicators receive a 1/6 weight but each of the standard of living indicators receive a 1/15 weight (1/3 ÷ 5). Similarly, if there is one missing indicator in the education dimension, then each of the

the number of indicators per dimension is changed, the weights will need to be adjusted according to the same principle as above. Alternatively, if there are well-justified reasons for a different weighting, such as giving more weight to the health dimensions, the weights can also be adjusted to this alternative structure. However, note that intricate weighting systems create challenges in interpretation, so it can be useful to choose the dimensions such that the natural weights among them are roughly equal and then apply robustness tests.

Here we note the indicator i weight as w_i, with $\sum_{i=1}^{d} w_i = 1$.

Step 6: Choosing the poverty cut-off (to identify the poor)

Next, each person is assigned a deprivation score according to his or her deprivations in the component indicators. The deprivation score of each person is calculated by taking a weighted sum of the number of deprivations, so that the deprivation score for each person lies between 0 and 1. The score increases as the number of deprivations of the person increases and reaches its maximum of 1 when the person is deprived in all component indicators. A person, who is not deprived in any indicator, receives a score equal to 0. Formally:

$$c_i = w_1 I_1 + w_2 I_2 + ... + w_d I_d$$

where $I_i = 1$ if the person is deprived in indicator i and $I_i = 0$ otherwise, and w_i is the weight attached to indicator i with $\sum_{i=1}^{d} w_i = 1$

A second cut-off or threshold is used to identify the multidimensionally poor, which in the Alkire-Foster methodology is called the **poverty cut-off.** In this chapter we define the poverty cut-off as the share of (weighted) deprivations a person must have in order to be considered poor, and we will note it with k.[6] In this way, someone is considered poor if her deprivation score is equal or greater than the poverty cut-off. Formally, someone is poor if $c_i \geq k$. In the MPI, a person is identified as poor if he or she has a deprivation score higher than or equal to 1/3. In other words, a person's deprivation must be no less than a third of the (weighted) considered indicators to be considered **MPI poor.**[7] For those whose deprivation score is below the poverty cut-off, even if it is non-zero, this is replaced by a "0"; what we call **censoring** in poverty measurement. To differentiate between the original deprivation score from the censored one, we use for the censored deprivation score the notation $c_i(k)$. Note that when $c_i \geq k$, then $c_i(k) = c_i$, but if $c_i < k$, then $c_i(k) = 0$. $c_i(k)$ is the deprivation score of the **poor**.

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health indicators receives 1/6 weight, each of the standard of living indicators receives a 1/18 weight but the one education indicator receives a 1/3 weight. Note that in the notation of this chapter, the indicators' weights add up to 1. This differs from Alkire and Foster notation, where the indicators weights add up to the total number of indicators considered. However, the notation here is made equivalent to the notation in the original paper.

[6] Again, this notation differs from Alkire and Foster (2007, 2011a)'s paper, where k is defined as the *number* of deprivations someone must experience in order to be considered poor. But notation is consistent throughout this chapter and equivalent to the original paper.

[7] Households with a deprivation score between 1/5 and 1/3 are considered vulnerable to or at risk of becoming multidimensionally poor.

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When designing a national measure however, one may set a different poverty cut-off. Moreover, one needs to do a sensitivity analysis to see how the rankings of regions within a country or other groups are altered when a different poverty cut-off is used. When this sensitivity analysis was performed for the global MPI, each country (of the 104 that were included in the 2010 estimates) was compared with another and in 94.5 per cent of the cases the relationship of one being poorer than the other was not altered by changing the poverty cut-off freely between 1/5 to 2/5.

Step 7: Computing the MPI

As mentioned in the overview, the MPI combines two key pieces of information: (1) the **proportion** or **incidence** of people (within a given population) who experience multiple deprivations and (2) the **intensity** of their deprivation: the average proportion of (weighted) deprivations they experience. Formally, the first component is called the **multidimensional headcount ratio** (H):

$$H = \frac{q}{n}$$

Here q is the number of people who are multidimensionally poor and n is the total population. The second component is called the **intensity** (or breadth) of poverty (A). It is the average deprivation score of the multidimensionally poor people and can be expressed as:

$$A = \frac{\sum_{i=1}^{n} c_i(k)}{q}$$

where $c_i(k)$ is the censored deprivation score of individual i and q is the number of people who are multidimensionally poor.[8]

The MPI is the product of both: MPI $= H \times A$.

3.2. Example

A hypothetical example of people living in 4 households can help explain how the MPI is constructed.

Table 1. Example using hypothetical data

Indicators	People in Households				Weights
	1	2	3	4	
Household size	4	7	5	4	
Education					
No one has completed five years of schooling	0	1	0	1	1/6=0.167
At least one school-age child not enrolled in school	0	1	0	0	1/6=0.167
Health					
At least one member is malnourished	0	0	1	0	1/6=0.167

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[8] Note that the formula of A differs the one you can find in Alkire and Foster (2007, 2011a) in that it does not contain d in its denominator. This is because d is already included in the deprivation score $c_i(k)$, since it is a weighted sum of the deprivations of each poor person, where the indicators' weights add up to 1.

One or more children have died	1	1	0	1	1/6=0.167
Living Standards					
No electricity	0	1	1	1	1/18=0.056
No access to clean drinking water	0	0	1	0	1/18=0.056
No access to adequate sanitation	0	1	1	0	1/18=0.056
House has dirt floor	0	0	0	0	1/18=0.056
Household uses "dirty" cooking fuel (dung, firewood or charcoal)	1	1	1	1	1/18=0.056
Household has no car and owns at most one bicycle, motorcycle, radio, refrigerator, telephone or television	0	1	0	1	1/18=0.056
Score c_i (sum of each deprivation multiplied by its weight)	**0.222**	**0.722**	**0.389**	**0.500**	
Is the household poor ($c \geq 1/3 = 0.333$)?	**No**	**Yes**	**Yes**	**Yes**	
Censored score $c_i(k)$	**0**	**0.722**	**0.389**	**0.500**	

Note: 1 indicates deprivation in the indicator; 0 indicates non-deprivation.

Score of each person in household 1: $c_i = \left(1 \times \dfrac{1}{6}\right) + \left(1 \times \dfrac{1}{18}\right) = 0.222$.

Multidimensional Headcount ratio $(H) = \left(\dfrac{7+5+4}{4+7+5+4}\right) = 0.800$

Intensity of poverty $(A) = \dfrac{(0 \times 4) + (0.722 \times 7) + (0.389 \times 5) + (0.500 \times 4)}{(7+5+4)} = 0.5625$

$\text{MPI} = H \times A = 0.450$.

3.3 Interpretation

The interpretation for the example in table 1 is straightforward: in this society 80 per cent of people are MPI poor. According to the MPI, this means that they are in acute poverty. They are deprived at least either a) all the indicators of a single dimension or b) a combination across dimensions such as being in a household with a malnourished person, no clean water, a dirt floor and un-improved sanitation.

We also learn that—on average—the poor here are deprived in 56 per cent of the weighted indicators.

The MPI represents the share of the population that is multidimensionally poor **adjusted** by the intensity of the deprivation suffered. This adjustment is necessary because if we only look at H we merely know that 80 per cent of the population is poor. But are they all equally poor? Are they deprived in 100 per cent of all the considered deprivations? In this society, they are not.

The average poor person is deprived in 56 per cent of the weighted indicators, so the intensity is 56 per cent. These are called "weighted" indicators, because to create the deprivation score c_i each deprivation is entered according to its relative weight (see the weights as described in the table above).

The 80 per cent figure is "adjusted" by the intensity of poverty, and that is why the MPI is what Alkire and Foster (2007, 2011a) call the Adjusted Headcount Ratio. If there was a society with 80

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per cent poor people, and all of them were deprived in **all** the indicators, then A would be 1, and thus the MPI would equal H. Alternatively, if there was a society where 100 per cent of people were poor, then the MPI would be equal to A.

A different but related way of interpreting the MPI is to say that it reflects **the proportion of weighted deprivations that the poor experience in a society out of all the total potential deprivations that the society could experience**. If everyone was deprived in all the considered indicators in a society the MPI would be 100 per cent. If, as in the example, the 80 per cent of people who are poor were deprived in all the considered indicators, the MPI would be 80 per cent. However, because they are on average deprived in 56 per cent of the weighted indicators, that society is deprived in 45 per cent of the total potential deprivations it could experience overall.

A real world example may provide further insight. Table 2 shows that in the 2010 MPI figures, Burkina Faso and Liberia had the same multidimensional headcount ratio. Yet they have different intensities of poverty, and that is why, in turn, they have different MPIs.

Table 2. The MPI: Adjusting the Headcount Ratio by the Intensity

Country	H	A	M0
Burkina Faso (MICS 2006)	0.826	0.649	0.536
Liberia (DHS 2007)	0.839	0.577	0.485

3.4 Understanding what MPI indicators mean
It is worth emphasising two characteristics that the MPI indicators have that differentiate them from indicators typically used in other reports and statistics. The first characteristic is that person is **identified as poor** depending upon achievements of the entire Household. The second is that **MPI considers only the deprivations of the multidimensionally poor**. This process is called **censoring**, since it ignores deprivations of people that do not reach the **poverty cut-off**—people who experience some deprivation but are not deprived in 1/3 of the weighted indicators. These characteristics and their practical consequences are explained here.

The identification of poor people based on household achievements
As explained, the data for the MPI provide achievements of some, but not all, members of each household. For the living standard indicators this makes no difference and deprivations are defined in a similar way to the MDGs: a person who does not have improved sanitation in her household is considered deprived. However, for the health and education indicators, the identification of deprivation and poverty differs from usual practices.

If there is a school-age child not attending school in the household, each household member considered deprived in the school attendance indicator, even though they are beyond school age or despite the fact that they may be themselves attending school or have completed schooling. There is an implicit assumption of a **shared negative effect** (called in economics "externality") within the household as the result of a child not attending school. Conversely, if there is one member with five years of education, each household member is considered non-deprived in years of schooling, even

though not all of them may have these years of education. Here there is an implicit assumption of a **shared positive effect** as the result of someone having achieved that level of education.

Similarly, if someone is undernourished in the household (given the data sources used, this is often either a woman in reproductive age or an under 5 child), each household member is considered deprived in nutrition, again, assuming a negative externality. And if there has been a child death in the household, everyone in the household has this deprivation attached.

The above procedure is used to determine deprivations. From this analysis one can obtain deprivation rates in each indicator, what are called **raw headcount ratios.** For living standard indicators these are similar to the MDG indicators, but it is crucial to understand that for health and education they completely differ from traditional statistics as both numerator and denominators are different.

Traditional education statistics look at the proportion of children attending (or not attending) school and proportion of people with (or without) five years of education, rather than the proportion of people in households with all children attending school and the proportion of people in households where there is at least someone with five years of education.

Traditional health statistics meanwhile look at the proportion of undernourished women or the proportion of undernourished children, not the proportion of people in households with an undernourished person. They also look at the number of children under five born alive who die for every 1000 born alive, rather than the proportion of people in households where there has been a child death.

Censoring the deprivations of the non-poor
After determining whether each household is deprived in each indicator, the next step is to weight those deprivations and add them up. This "score" will then be used to determine whether the household is poor or not. If the sum of the household's weighted deprivation is 1/3 or more of total possible deprivations, then it will be poor. If a household's weighted deprivations do not add up to 1/3 of the total, then that household is considered non-poor.

This is a crucial step within the identification part of the MPI. The deprivations of the non-poor households will be ignored and in formal terms this means that their deprivations are censored. All analyses of the MPI—by region or by component—reflect this censoring, hence the difference between the deprivation score c_i and the censored deprivation score $c_i(k)$ explained in Step 6 of section 3.

The example used in table 1 can help explain how this works. Household 1 is deprived in two indicators: the household has experienced a child death and it cooks with dung, firewood or charcoal. However, the sum of these weighted deprivations is 22 per cent, not 33 per cent. Thus, this household is identified as non-poor. Its deprivations are not counted in the MPI; the household is included in the headcount ratio (H) only in the denominator, as part of the total population, but not as poor, and its 22 per cent deprivations are replaced by "0" in the intensity (A). This is the censoring.

Once the MPI has been computed and the deprivations of the non-poor have been censored, one can look at the **censored headcount ratios**: the proportion of people who are **poor and deprived** in each of the indicators. These headcount ratios differ from the raw headcount ratios in that they only consider the deprivations of those that are poor, ignoring the deprivations of the non-poor (in other words, counting them as zero).

In the example considered, we can see that 100 per cent of people are deprived in cooking fuel; this is the raw headcount ratio. However 80 per cent are poor and deprived in cooking fuel; this is the censored headcount ratio. Similarly, 75 per cent of people have experienced a child death in the household; this is the raw headcount ratio, but only 55 per cent are poor and have experienced a child death in the household.

Thus, the censoring adds one more source of difference from traditional statistics: the **numerator** is the people identified as poor and who are deprived in a certain indicator; the **denominator** is the total population.[9] This means that the mortality censored headcount ratio of 55 per cent should not be compared with the infant mortality rate, nor should be the other censored headcount ratios compared with traditional statistics reported elsewhere.

Why do censored headcount ratios make sense? There are four main reasons:
- Raw headcount ratios may not indicate deprivation accurately due to poor data quality or incomplete indicators.[10]
- People with multiple deprivations are more likely to be poor and are more likely to be poorer than those experiencing only a single deprivation. We want to focus on the acutely poor. [11]
- They provide a more accurate idea of the magnitude of the deprivation in a specific indicator when associated with poverty.
- Raw headcount ratios may include people that "choose" to be deprived in that indicator.

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[9] Please note that **censored headcount ratios are not the proportion of the poor deprived in a certain indicator**. That is an interesting but different statistic, which can be obtained by dividing the censored headcount ratio by H.

[10] For example a person may cook with wood but also have good ventilation so cooking with wood does not create a risk of respiratory or eye infections. As most MPI surveys do not include information on ventilation, every person cooking with wood would be (erroneously in some cases) identified as deprived.

[11] Again exceptions could be imagined, but in the example above, if a person cooks with wood and is uneducated and has experienced a child death they are more likely to be poor than a person who only cooks with wood. Thus in a crude way, requiring multiple deprivations focuses attention on people who are more clearly poor. In national poverty measures, this accuracy can be further improved.

4. POTENTIAL INNOVATIONS

The MPI has been designed for international comparability and thus its dimensions and indicators are fixed across countries. This allows the multidimensional poverty levels in a country to be seen vis-à-vis the rest of the world, providing relevant information for policy design by national governments and the international community. However, poverty is context specific. Thus, while national teams are encouraged to adopt this methodology, they are also urged to make use of indicators relevant to their countries' specific situation.

The MPI follows the Alkire-Foster (AF) methodology developed by Sabina Alkire and James Foster (2011). This measure assesses the simultaneous or "joint" deprivations poor people or households experience in a set of indicators.[12] The method is flexible and can be used with different dimensions, indicators, weights and cut-offs to create measures specific to different societies and situations. It can be used to measure poverty or well-being, target services or conditional cash transfers and for monitoring and evaluation of programmes.

The method allows extensions to more indicators and dimensions or other type of adaptations, in terms of cut-offs and weights. It is absolutely feasible to have the global MPI for international comparisons and for a national team to produce a *national* MPI that is more relevant to the specific context and needs. Possible adaptations are outlined below.

4.1 Customising the MPI

Countries are strongly encouraged to innovate in the creation of national-level MPIs. National exercises using the AF methodology are not bound by the dimensions, indicators, cut-offs or weights selected for the global MPI, which were selected to guarantee *international comparability*. It is important to stress though that innovation should be consistent with rigorous statistical standards, and that tests should be applied to assess the robustness of the measure to plausible changes in indicators, cut-offs, and weights (see section 5.4). Yet these requirements leave plenty of room for innovation to better reflect the priorities and problems relevant to a country's level of development. Adjustments to the MPI could involve the following.

Changes in the dimensions
Countries may want to add, reduce or replace altogether the dimensions used. For example, countries have included dimensions such as income, employment and housing. Other possible dimensions might be violence or disempowerment.

Changes in the indicators
Countries may want to add, reduce or replace the indicators used. For example, the entire set of **educational indicators** may be adapted to better adjust the MPI to the national context. If there were reasons to think, for example, that it is necessary that every household member, and not just at least one, has completed five years of education (or secondary education, if that's the standard), one can use this indicator. Similarly, to introduce an element of quality, one may require children of school age to attend the grade they are supposed to attend.

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[12] One novelty of the methodology is that it reflects the joint distribution of deprivations by counting all the deprivations a given household experiences across all (weighted) indicators. The poorest of the poor, in this methodology, are those who are deprived in all dimensions at the same time. When data are cardinal, the "depth" or "severity" of deprivation in each dimension can also be used to identify the poorest of the poor.

Moreover, if a country used a multipurpose survey that collects information on the actual cognitive skills of each household member, one could define an indicator demanding that all household members of a certain age and above (or at least one) have certain cognitive skills. The possibilities are many, and each country can adapt the educational indicators to its own context.

Similarly, the **health indicators** can be adapted. One minor adaptation could be using a different nutritional indicator for children, such as stunting (height-for-age) or wasting (weight-for-height) rather than under-weight as in the global MPI. For the mortality indicator a national office could consider using information on the recent deaths of children under five years of age, or to consider other aspects of health such as disability or morbidity.

National governments may also want to implement a multidimensional measure to track progress on a more frequent basis than allowed by DHS data. A national household survey may then be used and the indicators can be adapted according to the information required. However, it must be emphasised that the survey should be an instrument serving the monitoring measure and not the other way round.

Furthermore, if a country considers that nutrition and child mortality are no longer major problems, these indicators can be replaced by others considered more appropriate to the specific health challenges in place. For example, among developed countries a question on whether a person can perform certain daily life activities on their own or whether they require help is often used. Box 2 provides some real-world examples of national multidimensional poverty measures and their indicators.

Changing the deprivation cut-offs
Deprivation cut-offs that are more or less demanding can be used for national monitoring than those presented for the global MPI. For example, people in certain countries may actually need a complete secondary education (rather than only primary) to enjoy a number of other functionings, such as being able to enjoy a job in the formal market or engage in political discussions. Thus the cut-off for the years of education may be modified to require at least one household member to have completed secondary education. Similarly, one may demand children of school age attend school for more than eight years if compulsory education lasts longer.

Adjusting weights
Countries may also want to adopt different weights based on national priorities. Clearly equal weights are far easier to interpret, so one alternative to changing the weights on the MPI's three dimensions (for example) is to select a set of dimensions such that the weights could be roughly equal. Examples of all of these innovations are presented below.

Box 2: Examples of country innovations

Several countries have innovated in the creation of their own multidimensional poverty measures.

Mexico
Mexico launched the first national multidimensional poverty measure drawing on the AF method in 2009. This measure is a good example of innovation as the Mexican government included features relevant to their national priorities and introduced new methodological aspects. It is also a good example of adaptation of the methodology behind the MPI.

The measure combines two over-arching categories social rights and economic well-being. Economic well-being is measured by income, and social rights have six components: education, health, social security, housing, basic services, and food security. The whole population is mapped in terms of social rights: those who are not deprived in access to any social right, and those who are deprived in access to at least one social right (and three for the extreme poor). The population is also mapped in the income space and divided between those whose income is too low to meet all their basic needs (and food basket, for the extreme poor) and those who are not income poor.

This mapping identifies five groups:

Multidimensionally poor: people who don't have enough income to afford bare necessities **and** those who have at least one deprivation in the social rights' sphere.[13]

Extreme multidimensionally poor: people who do not have enough income to fulfill the minimum food requirement **and** have at least three social deprivations. They are a sub-group within the multidimensionally poor.

Vulnerable by income: income poor people who do not lack any social right.

Vulnerable by social rights: people who are not income poor, but who suffer at least one social deprivation.

Well-being: people with enough income to meet their basic needs and who are not deprived of any social right.

The dimensions, weights and cut-offs of the measure follow both the Mexican Constitution and the Law of Social Development. As economic well-being and social rights are considered equally important, each accounts for 50 per cent of the measure. Within the social rights component all dimensions are defined as rights (and, moreover, equally important rights) by the Constitution. Thus, equal weight is assigned to each social dimension. At the same time, Mexican regulations have selected various deprivation cut-offs. For instance, the Constitution indicates that the minimum educational level in Mexico should be secondary school.
Source: National Council for the Evaluation of Social Policy (CONEVAL)

Colombia
Colombia launched its national multidimensional poverty measure in 2011. The National Planning Department (DNP) designed an official multidimensional poverty measure that includes:

- Education (literacy and educational attainment)
- Condition of children and youth (including school attendance, educational gap, child work and infants' health care)
- Employment
- Health
- Access to public services and housing conditions

These dimensions are measured through 15 indicators. A person is considered multidimensionally poor by this measure when deprived in at least 33 per cent of the indicators, and she is considered to be in extreme poverty when deprived in at least 47 per cent of the indicators.

Both the dimensions and indicators of the Colombian measure were defined according to the social policy of the government. They were informed by consultations with the academic community and national and international experts, analysis of previous Colombian measures and discussions within different units of the government. Colombia's national multidimensional poverty is used alongside its income poverty measure.
Source: National Planning Department (DNP), Republic of Colombia

The same innovations as outlined in box 2 are also possible for sub-national levels if the data are available for characteristics such as ethnic groups, urban and rural locations, geographic regions (districts/provinces/states), religion and caste, as well as other key household and community

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[13] The overall poverty cut-off identifies a person as multidimensionally poor if they are income poor and deprived in at least one social deprivation (that is, their weighted deprivations exceed 50 per cent).

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characteristics. Such national and sub-national adaptations will greatly enhance the usefulness and versatility of the MPI as an analytical tool for poverty reduction. Section 5 has more information about decomposing by population sub-groups.

5. ANALYSIS AND DECOMPOSITION

The MPI methodology shows aspects in which the poor are deprived and helps to reveal the interconnections among those deprivations. It identifies the joint or simultaneous deprivations poor people experience. This enables policymakers to target resources and design policies more effectively. This is especially useful where the MPI reveals areas or groups characterized by high intensities of deprivation. Mexico's multidimensional poverty measure outlined earlier is one such example.

The MPI condenses a lot of information. It can and must be unpacked to show the composition of poverty both across countries, regions and the world, as well as within countries by ethnic group, urban and rural location, and other key household and community characteristics. This is why the MPI is sometimes described as a high resolution lens on poverty: it can be used as an analytical tool to identify the most prevalent deprivations.

5.1 Incidence vs. intensity

We have already explained that the MPI is the product of two very informative measures: the headcount ratio—**poverty incidence**—and the average deprivation share across the poor—**poverty intensity**. Both are relevant and informative, and it is useful to present them both. The examples of Burkina Faso and Liberia in table 2 showed this clearly.

5.2 Decomposing by population sub-groups

One key feature of the MPI is that it can be decomposed by population sub-groups. When analysing country-level estimates, the question here is which population sub-groups are relevant to a given country, and whether the data used allows such estimations to be calculated in a representative way.

Relevant sub-groups may include urban vs. rural, geographic regions (districts/provinces/states), religion, caste and ethnicity. Any characteristic that may imply a relevant difference across households such as gender and age group of the household head can also be a relevant variable. Always remember, however, that in the global MPI the unit of analysis is the household. Of course, if you have designed a national MPI at an individual level, you may do further decompositions by groups such as gender and age (and not just the characteristics of the household head). In thinking of "relevant" groups to decompose, an important guideline is whether data at this level will be useful for policy action.

Finally, to perform any decomposition it is necessary that the data used is representative of those groups. Thus a first step is to check the sample design and representativeness of the survey used. Be certain to use the survey weights if that is recommended by the survey (it usually is).

How to decompose by sub-groups?

An easy way to do this is to think of each sub-group as the total population over which the MPI will be computed. Thus, if you are decomposing by urban and rural populations, you would take all (and

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only) the urban households and compute the MPI in the same way as you did for the total population. Then you do the same for the rural households.

Once this is done, you have the MPI for each urban and rural region. From the urban and rural MPI you can obtain the overall MPI. This can be verified, because if you do a weighted sum of the MPI of the urban and the rural areas, using the population shares as weights, you will obtain the MPI for the whole country.

The formula for this is as follows:

$$MPI_{country} = \frac{n_U}{n} MPI_U + \frac{n_R}{n} MPI_R$$

Here U denotes "urban" and R denotes "rural," and n_U / n is the population of urban areas divided by the total population, and similarly for n_R / n (assuming that $n_U + n_R = n$). This relationship holds for as many groups as you have, as long as they all add up to the total population.

Given the above expression one can easily compute the contribution of each group to overall poverty simply by using the following formula:

$$Contribution\ of\ urban\ areas\ to\ MPI = \frac{\frac{n_U}{n} MPI_U}{MPI_{country}} * 100$$

Whenever the contribution to poverty of a region or some other group widely exceeds its population share, this suggests that there is a seriously unequal distribution of poverty in the country, with some regions or groups bearing a disproportionate share of poverty. Clearly, the sum of the contributions of all groups needs to be 100 per cent.

Using the hypothetical example explained earlier we could imagine that households 1 and 2 are in urban areas, and households 3 and 4 are in rural areas. The MPI of the two urban households is 0.46, which can be obtained as a product of H=0.64 and A=0.72. The MPI of the two rural households is 0.44, which is obtained as a product of H=1 and A=0.44. The urban households contribute 55 per cent of the total population, whereas the rural ones contribute the other 45 per cent. Thus, following the decomposition formula, it can be verified that: 0.55*0.46+0.45*0.44=0.45 is the overall MPI. It can also be verified that the urban population contributes 56 per cent to total poverty, close to its population share.

5.3 Decomposing by dimensions and indicators

Another key feature of the MPI is that, once the poor have been identified (in other words, once the MPI has been computed), one can decompose the MPI into its component censored indicators. There is an analogy here with the previous decomposition. We have seen that when we decompose the MPI by population sub-groups, one can look at the **MPI in each group** but also at the **contribution** of that group to total MPI. Each tells a different and complementary story. The MPI of each group provides information about levels of poverty in each group. The contribution merges this with the weight of this region in the overall context (the population share) and reveals how

much that region is increasing overall poverty, which can come either from a high weight (a high population share) or from high poverty (a high MPI).

In a similar fashion, when decomposing by indicators, one can look at the **censored headcount ratios** but also at the **contribution of deprivation** in each particular indicator. Again, each tells a different story. One can also compare raw and censored headcount ratios to explore which deprivations were censored and ensure that these actually improve accuracy.

How to decompose by indicators?

An easy way to decompose by indicators is to compute the censored headcount ratio in each indicator, which we have already explained. The censored headcount ratio is obtained simply adding up the number of people who are poor and deprived in that indicator and dividing by the total population. Once all the censored headcount ratios have been computed, it can be verified that if you do a weighted sum of the censored headcount ratios, you will obtain the country's MPI.

In a formula, this can be verified as follows:

$$MPI_{country} = w_1 CH_1 + w_2 CH_2 + ... + w_{10} CH_{10}$$

Here w_1 is the weight of indicator 1 and CH_1 is the censored headcount ratio of indicator 1, and so on for the other nine indicators, with $\sum_{i=1}^{d} w_i = 1$. If you have designed a national MPI and you have more or less indicators, this relationship holds for as many indicators as you have, as long as you add them all up and the weights add up to 1.

Given the above expression, one can easily compute the contribution of each indicator to overall poverty simply by:

$$\text{Contribution of indicator i to MPI} = \frac{w_i CH_i}{MPI_{country}} * 100$$

Whenever the contribution to poverty of a certain indicator widely exceeds its weight, this suggests that there is a relative high deprivation in this indicator in the country. The poor are more deprived in this indicator than in others. Clearly, the sum of the contributions of all indicators needs to be 100 per cent.

Using the example from table 1, we can see that the censored headcount ratios and the contributions are outlined in table 3.

Table 3: Censored headcount ratios and contributions

Dimensions	Indicators	Censored Headcount Ratio	Weight	Contribution
Education	Years of Education	0.55	1/6	0.20
	Child School Attendance	0.35	1/6	0.13
Health	Nutrition	0.25	1/6	0.09
	Mortality	0.55	1/6	0.20
Living Standards	Electricity	0.80	1/18	0.10
	Water	0.25	1/18	0.03
	Sanitation	0.60	1/18	0.07
	Floor	0	1/18	0
	Cooking Fuel	0.80	1/18	0.10
	Assets	0.55	1/18	0.07

Looking at the censored headcount ratios we can see that the poor in this society exhibit the highest deprivation levels in access to electricity and cooking fuel, followed (though with much lower headcount ratios) by sanitation, years of education, mortality and assets. Yet it is not electricity nor sanitation nor assets that are the indicators with the highest contribution to poverty. Why? Because their weights are much lower than years of education and mortality, for example.

Contributions thus provide a picture of relative deprivation that is much influenced by weights. One warning is that when overall MPI is very low, the censored headcount ratios are also low, and contributions may be misleading. One indicator can have a 90 per cent contribution, not because there is a massive deprivation in that indicator but because it is one of the few indicators that has a non-zero censored headcount ratio, explaining most of the (very low) MPI. On the other hand, censored headcount ratios provide a picture of absolute deprivation. You may verify the decomposition formula by indicators expressed above using data from table 3.

Some indicators belong to the same dimension. One can estimate the contribution of each dimension simply adding up the contribution of each indicator within the dimension. Thus, in the analysed example, deprivation in education contributes 33 per cent to overall poverty.

5.4 Robustness checks
When analysing the MPI estimates there are a number of robustness checks that are worth performing.

Robustness to deprivation cut-offs. Are the rankings between countries, or between regions within a country, robust to changes in the deprivation cut-off? In a basic way, this requires computing the MPI for the set of countries or regions you are handling with slightly different deprivation cut-offs, or maybe different indicators altogether. For example, you may use stunting rather than under-weight for the nutritional indicator for children, or you may use a slightly more demanding criterion for what is considered "adequate sanitation." Once computed, build the rankings and then compute rank correlation coefficients such as Kendall's Tau b or Spearman. For examples and details, see Alkire and Santos (2010).

Robustness to the poverty cut-off. Are the rankings between countries, or between regions within a country, robust to changes in the poverty cut-off? The rankings may be robust to changes within a certain reasonable range, but not necessarily for every possible cut-off value. At the most basic level,

this requires computing the MPI for the set of countries or regions you are handling with different poverty cut-offs, and not just the 1/3 cut-off, then building the rankings and computing rank correlation coefficients such as Kendall's Tau b or Spearman. For examples and details, see Alkire and Santos (2010).

Robustness to weight. Are the rankings between countries, or between regions within a country, robust to changing the indicators' weights? Rankings may be robust to changes in indicator weights across a reasonable sets of weights. At the most basic level, this requires computing the MPI for the set of countries or regions using alternative weighting schemes, building the rankings, and then computing rank correlation coefficients such as Kendall's Tau b or Spearman. For examples and details, see Alkire and Santos (2010) and Alkire et al (2010).

Bootstrapping and Standard Errors. MPI estimates, as well as its components H and A, may vary with the sample. A very basic statistical principle is that point estimates are proxies to the true value of the parameter but they are not exactly the true value. Point estimates vary with changes in the sample. The question is how much? The reliability of the point estimate depends upon the variability around it. That is why it is useful to construct confidence intervals around the point estimate to know how much that point estimate can vary. This may be done using analytical standard errors or using an empirical technique called bootstrapping. See Yalonetzky (2011).

Box 3: Key findings from 2010

When thinking about how the MPI can be analysed, some MPI findings from the 2010 *HDR* provide useful illustrative examples of the kinds of results which are possible:

- About **1.7 billion people** in the 104 countries covered by the MPI, a third of their population, live in multidimensional poverty—that is, in acute poverty with deprivations in at least a third of the dimensions of health, education and living standard. This exceeds the estimated 1.4 billion people in those countries who live on $1.25 a day or less (though it is below the share who live on $2 or less).[14]

- **Patterns of deprivation** also differ from those of income poverty in important ways: in many countries—including Ethiopia and Guatemala—the number of people who are multidimensionally poor is much higher. However, in about a fourth of the countries for which both estimates are available—including Tanzania and Uzbekistan—rates of income poverty are higher.

- **Sub-Saharan Africa** has the highest incidence of multidimensional poverty. The 2010 estimates suggest that multidimensional poverty incidence reached a massive 93 per cent in Niger; while intensity ranges from about 45 per cent (in Gabon and Lesotho) to 69 per cent (in Niger). Yet half the world's multidimensionally poor live in South Asia (844 million people), and more than a quarter live in Africa (458 million).

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[14] Note that international population aggregations in *HDR* 2010 were based on 2007 population data, which requires strong assumptions. Population comparisons are not problematic when a single survey year is used.

6. DATA PRESENTATION

When presenting the results of MPI estimates and analysis it is worth investing some time in thinking of illustrative graphs that provide clear analyses of poverty and improve the resultant poverty reduction policies. This is particularly important at the national level. The *HDR 2010* included useful graphs, as presented below.

6.1 Incidence vs. Intensity

Figure 2 illustrates that the higher the incidence of poverty (H), the higher its intensity (A). The size of the bubble denotes the population size of the country.

**Figure 2: Average intensity of poverty relative to share of population considered poor**
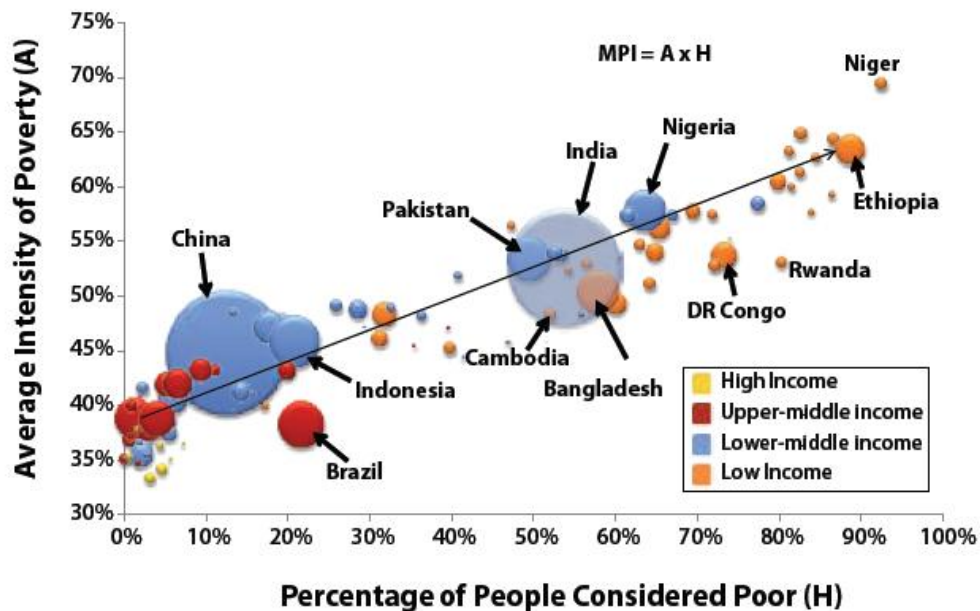
Source: *HDR* 2010, Figure 5.9, p. 98, from Alkire and Santos (2010), revised.

6. 2 Decomposing by population sub-groups

Figure 3 illustrates the distribution of the total multidimensionally poor population (as estimated in the 2010 *HDR* with 104 countries) according to region. We can see that South Asia concentrates the highest share of the MPI poor, followed by Sub-Saharan Africa.

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Figure 3: Distribution of the world's multidimensional poor living in developing countries
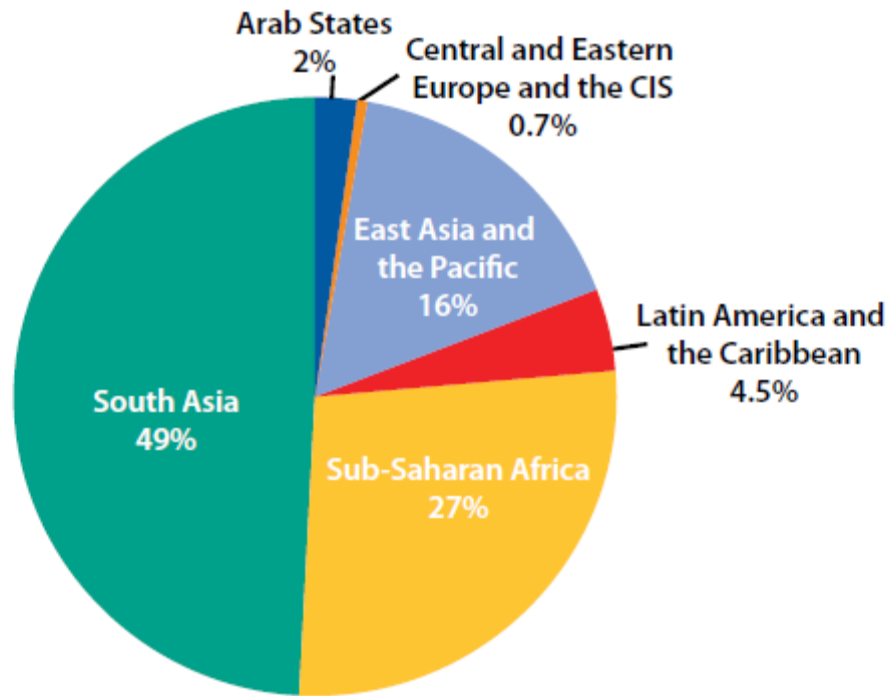
Source: *HDR* 2010, Figure 5.10, p. 98, from Alkire and Santos (2010), revised.

Figure 4 illustrates a decomposition exercise done for Kenya, comparing the MPI of its various regions with the aggregate MPI of other countries. In this way we can see that there is a huge range of MPI within Kenya

**Figure 4 Poverty in Kenya's province compared with other countries**
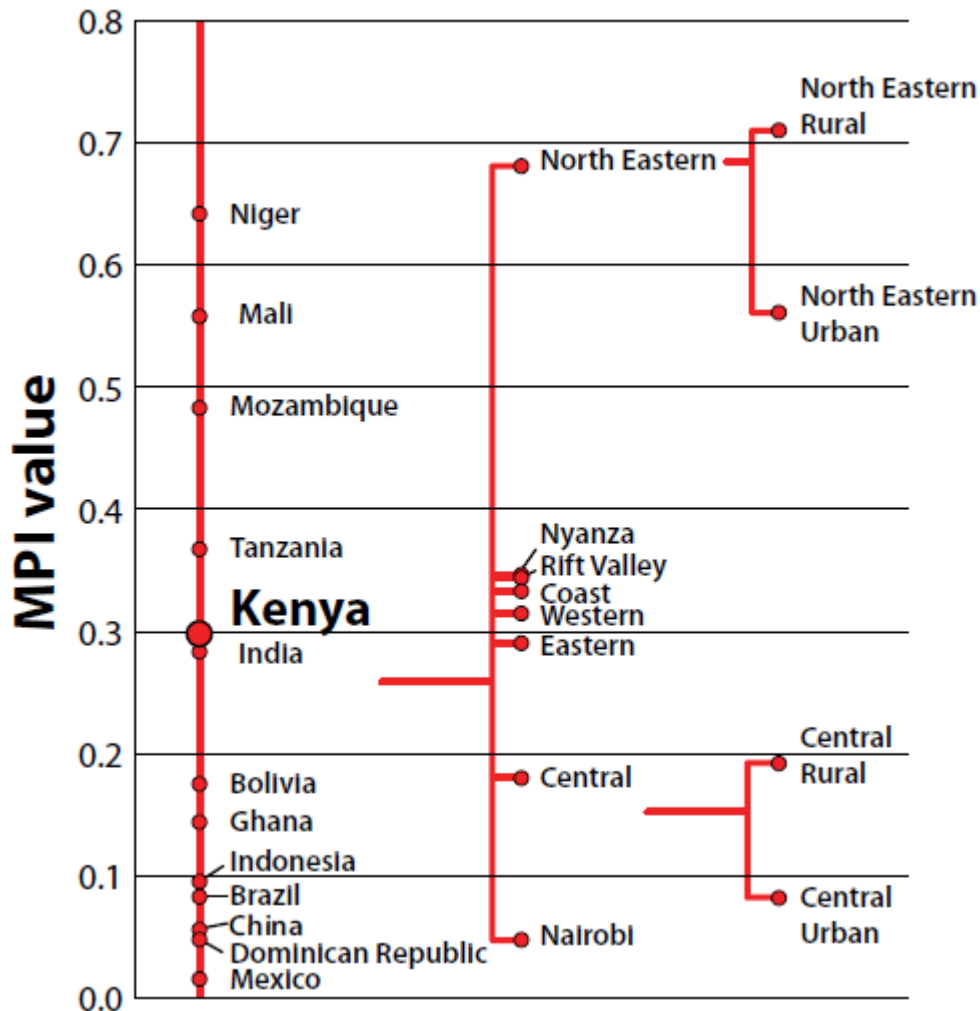
Source: *HDR* 2010, Figure 5.11, p. 99, from Alkire and Santos (2010), revised.

6.3 Decomposing by dimensions and indicators

Figure 5 presents the composition of poverty in one Indian state, Madhya Pradesh, which has a MPI similar to that of the Democratic Republic (DR) of Congo. Moreover, Madhya Pradesh has a similar population size to the DR Congo (70 million vs. 67.6 million correspondingly). Yet, despite similar population sizes and similar MPI, the composition is notably different. Deprivation in the health dimension (especially nutrition) contributes much more in Madhya Pradesh than in DR Congo, while deprivation in living standards contributes relatively more in the latter.

Figure 5: The contribution of indicators to MPI: Madhya Pradesh and DR Congo
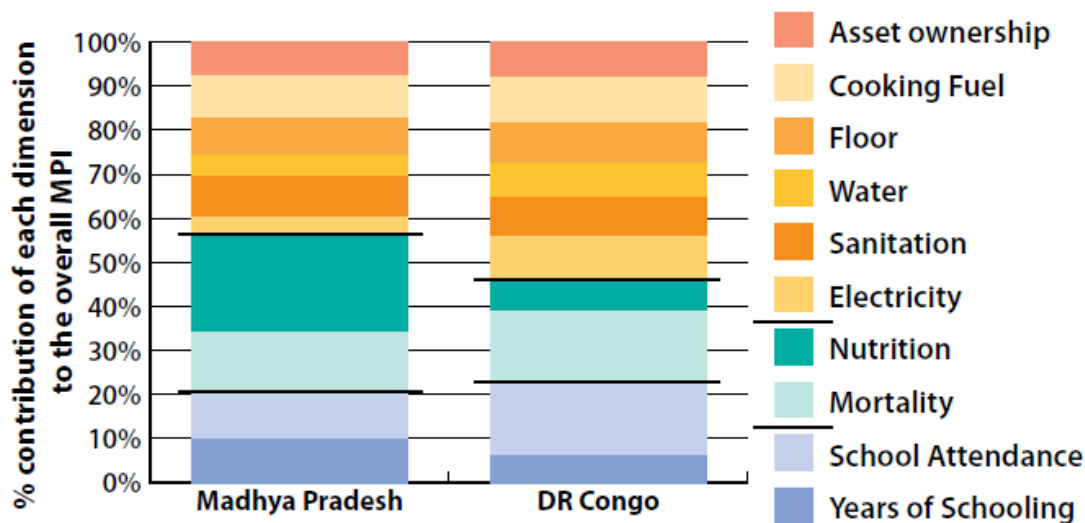
Source: Data are drawn from the Demographic and health surveys (DHS) for the DR Congo (2007) and Madhya and Pradesh (2006), which are nationally representative household surveys. For details see Alkire and Santos (2010).

7. MULTIDIMENSIONAL POVERTY AND INCOME POVERTY

Poverty has traditionally been measured in one dimension, usually income or consumption. In this analysis, a basket of goods and services considered the minimum requirement to live a non-impoverished life is valued at the current prices and people who do not have an income sufficient to cover that basket are deemed poor. Income poverty certainly provides very useful information. But it does not seem to be enough for several reasons.

In the first place, income is not always a good guide to whether people have access to what they find valuable and necessary in life. One might expect that income poverty is a sufficiently good proxy for other deprivations such as malnutrition, low education, and poor housing conditions. Surprisingly, it may not be. Some important needs are not satisfied in the market, or markets function very imperfectly. In those cases, non-market institutions are required to provide for those needs. One example of this is access to clean water and education, which are sometimes provided by the state. Thus, a family may enjoy the minimum income and yet still not satisfy some basic needs. On the other hand, in certain areas with a very strong presence of the state or NGOs, households who do not reach the minimum income level may access goods and services anyway.

Second, each household has a different capacity to convert income into satisfaction of needs. Households with disabled people, households in rural areas far away from markets and public services, and households with very low educational levels may not be able to access the basket of goods and services that in theory they should be able to access with the income they earn.

Third, income is merely a means to ends. It is the ends which are valuable, not the means. We are interested in whether a person has certain cognitive skills, not whether she has the income to attend school. We are interested in whether a person is well nourished, not whether she has the income to be so.

And fourth, income poverty is unidimensional: if we know a person is income poor that is all we know about them. Whereas if we know they are multidimensionally poor, we can then (with the AF method) take the next step and see **how** they are poor – look at the deprivations they experience at the same time. This gives direct and important information for poverty reduction.

Though there are other problems with income poverty, these are four important reasons why income poverty, although relevant, falls short of an accurate characterization of poverty.

The magnitude of the mismatch between income poverty and multidimensional poverty varies across countries. Whenever the surveys allow, we have analysed this. For example, we find that in China, there is a 12 percent probability that a person who is not income poor *is* multidimensionally poor; in Chad it is 59 percent (Alkire and Santos, 2010).

7.1 Differences between MPI and income poverty
The MPI differs from an income poverty measure in two main ways. The first difference is that it moves from the unidimensional space of income (or consumption) to a multidimensional space. In the unidimensional space someone is poor if she is deprived in income alone. With the MPI someone is poor if she is deprived in several indicators at the same time. There is a two-step procedure involved in moving to this multidimensional space: first, determining whether each person is below the deprivation cut-off of each indicator; and second, determining whether each person is below the cut-off in a sufficient proportion of indicators to be considered multidimensionally poor.

The second difference is that the MPI moves from means towards ends. It does so imperfectly due to a lack of proper data, but it is a step forward. The MPI examines whether there is someone undernourished in the household and whether someone has died. Both are clear functionings (ends rather than means to ends). Admittedly, it considers indicators of resources too, such as the indicators of living standards and education, but they are more direct indicators of deprivation than income.

7.2 Adding income to the MPI
At the moment, income is not included in the international MPI due to data constraints. A key data requirement of the MPI is that all the data of a country needs to come from the same survey so that one can identify households with several simultaneous deprivations. There are currently no internationally comparable household surveys that regularly collect information on both income and the health indicators considered in the MPI.

To include income in an internationally comparable measure using existing data one would need to move to another type of survey and exclude the relevant health indicators. Given the interest in privileging ends of development over means, this solution seems like a poor option. However, income could be incorporated into national multidimensional poverty measures if data are available in the same survey as data on health and if there are reasons to think it would add value to the poverty estimate. Whether adding income to the MPI would add value or not is essentially an empirical question that needs further research. It will be possible to further study this in countries for which data is available.

7.3 World Bank's $1.25/day line

One widely used internationally comparable poverty measure is the World Bank's $1.25/day, known as an internationally comparable measure of **extreme poverty** which identifies people who do not reach the minimum income poverty line. Like this measure, the MPI is also an internationally comparable measure. But the MPI is also a multidimensional measure, which measures **acute poverty**, revealing the people who do not reach the minimum standards in several indicators at the same time. Both $1.25/day poverty and MPI share one key feature: both are internationally comparable measures of serious poverty. And at the same time, an international poverty measure may not be right for most countries. For this reason, countries usually develop national income and/or multidimensional poverty measures for their internal policy purposes.

One essential difference between the two is that the MPI indicators are more direct, and the $1.25/day measure is more indirect. The indicator cut-offs of MPI are related to the MDGs. The MPI compares people who are malnourished, or who have no one with six years of schooling in their household, or lack electricity, clean fuel and clean water. The $1.25/day measure is more indirect, first because different currencies must be converted into dollars using purchasing power parity rates, an income poverty line must be set across all countries, and the measurement error of income surveys must be navigated.

The second essential difference is that the $1.25/day income poverty line measures the failure to access the minimum necessary means. The MPI measures the failure to enjoy direct functionings or resources that are closely related to certain functionings.

While there is a positive correlation between these two poverty measures, there is no perfect correspondence. The $1.25/day headcount ratios and the MPI headcount ratios do differ for many countries. This is a topic for further research, and some differences merely stem from different years of surveys. But other differences may be linked to the different way of measuring–indirect versus more direct. Thus, for example, some possibilities include failure or success in providing public services (for countries with higher or lower MPI than $1.25/day figures correspondingly), as well as different abilities to convert income into outcomes such as good nutrition. It is important to notice that even if the MPI and the $1.25/day headcount ratios are identical, this does not necessarily mean that the same **people** are identified as poor, because they measure poverty in different ways.

The MPI, like the $1.25/day line, is a globally comparable measure of poverty. It measures acute multidimensional poverty and only includes indicators that are available for many countries. The MPI is often also compared with national income poverty measures. The fact that there are differences does not mean that the national income poverty number or the MPI headcount ratio is wrong; they simply measure different conceptions of poverty. At the same time, just as national income poverty measures are designed to reflect the national situation more accurately than the $1.25 measure, so too national multidimensional poverty indices, which are tailored to a country's specific context, are tremendously useful to complement the international MPI.

7.4 MPI and the MDGs

The Millennium Development Goals (MDGs) are the most broadly supported, comprehensive and specific development goals the world has ever agreed upon. Adoption of the MDGs has increased comparable international data related to the goals and targets, provided feedback on development outcomes and created incentives to address core deprivations.

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Unlike the MPI, however, the international MDG reports invariably present progress on each indicator singly. No composite MDG index has been developed, and few studies have reflected the interconnections between indicators.

There are two reasons that no composite MDG index has been developed. First, the data often come from different surveys. Second, even when the data are in the same survey, the 'denominator' or base population of MDG indicators differ. In some cases it includes all people (malnutrition, income, drinking water, sanitation); in some cases children (primary school, immunization), or youth 15-24 (literacy), or childbearing women (maternal mortality), or urban slum dwellers (housing) or households' access to secure tenure and so on. Some environmental indicators do not refer to human populations at all.

Given this diversity of indicators, it is difficult to construct an index that meaningfully brings all deprivations into the same frame. The MPI begins to fill this gap. The MPI shows which people have key MDG deprivations at the same time. Eight of the MPI's ten indicators relate to MDG targets. Hence the MPI can be used to identify the most vulnerable people and identify different patterns of deprivations – clusters of deprivations that are common among different countries or groups.

The MPI can be used to understand the interconnections among deprivations, help target aid more effectively to the most vulnerable, identify poverty traps and consequently strengthen the impact of interventions required to meet the MDGs.

8. RELATIONSHIP WITH EARLIER INDICES AND LIMITATIONS

8.1. Relationship with Human Poverty Index (HPI)
From 1997-2009, poverty was measured in *HDR*s through the Human Poverty Index (HPI). In 2010, the MPI was introduced as an improvement upon the HPI. They are similar in that they share the same motivation: the desire to move away from the unidimensional space to a multidimensional one and to consider the ends of development rather than means.

The HPI was pioneering in its day and did the best possible with the data constraints of the moment. It used country averages to reflect aggregate deprivations in health, education and standards of living. It also introduced a "general means" method of aggregation, a variant of which is now part of the HDI.

The MPI takes advantage of the availability of multipurpose household surveys which allows data on different dimensions to be drawn from the same survey. The MPI's key innovation is that it identifies the *people* who experience overlapping deprivations. Each household has its own profile of multidimensional poverty in the MPI, which can also be broken down by indicator to show the composition of multidimensional poverty across different regions, ethnic groups or any other population sub-group, with useful implications for policy.

8.2 Limitations of the MPI
The MPI has some drawbacks, due mainly to data constraints. First, the indicators include both outputs, such as years of schooling, and inputs, such as cooking fuel. It also includes both stock and

flow indicators. A stock indicator is measured at a particular point in time, and it may have accumulated in the past. On the contrary, a flow indicator is measured per unit of time.

Whether children are attending school in the current year or whether the household has access to clean water and improved sanitation are flow indicators, which may change from one year to the next, as they are measured per time unit. However, whether the household has experienced a child death is clearly a stock indicator: it is measured at the moment of the survey, and it may reflect a death that was a long time ago. Surveys do not have flow indicators for all dimensions.

Second, the health data overlooks some groups' deprivations especially for nutrition. For example, in many countries there is no nutritional information for women. In other countries, there is no nutritional information for men, in others still, for children. Despite these serious drawbacks, the patterns that emerge are plausible and familiar.

Third, and connected with the above, although the MPI indicators were selected in order to guarantee as much cross-country comparability as possible, indicators' comparability is still imperfect for two reasons. First because, as detailed above in the case of nutrition, the information differs across the three surveys used. Second, because even when they collect the same information, the minimum acceptable standards on certain indicators, such as some of the living standard ones, may vary greatly according to the culture. However, it is worth noting that this is the case with any other internationally comparable measures such as income or the MDGs and that the MPI follows agreed international standards provided by the MDGs.

Fourth, as is well known, intra-household inequalities may be severe, but, for the moment, these cannot be reflected in the global MPI, precisely because there is no individual-level information for all the indicators. The health and living standard indicators, in particular, pose the main bottleneck here.

Fifth, as explained in Section 2.1, households with no school-aged children are considered non-deprived in school attendance. Also, households with no under-five children and no women in reproductive age are considered non-deprived in nutrition. Hence the incidence of deprivation in these indicators will reflect the demographic structure of the household and country. However, preliminary analysis of the magnitude of potential bias of poverty estimates to households with children and young women suggests that this effect is not significant (Alkire and Santos 2011, *mimeo*).

Sixth, while the MPI goes well beyond a headcount ratio to include the intensity of poverty experienced, it does not measure the depth of poverty—how far away, on average, from the deprivation cut-off in each indicator poor people are. Nor does it measure inequality among the poor—how deprivation is distributed among the poor. This is possible to do in national measures using the Alkire and Foster methodology, but is not reflected in the global MPI.

The methodology underlying the MPI can capture both of these (Alkire and Foster, 2011). The global MPI cannot implement some techniques because they require all the indicators to be cardinal, that is, that their values have a specific meaning. At the moment, many of the variables used to construct the MPI are ordinal. For example, the codings for the type of sanitation facility and the source of water have no cardinal meaning. However, the MPI can be decomposed by groups, and the distribution of deprivation scores can be analysed. Both of these reveal group-based inequalities.

Finally, there are limits to the cross-country comparability of the MPI. The estimates presented here are based on publicly available data and cover various years between 2000 and 2010. Not all countries have data on all indicators, and the respondents for the nutrition variable vary across countries. Better and more frequent data on poverty is urgently required.

8.3 Data constraints

In the past twenty years (1990–2010) there has been enormous progress in terms of data collection worldwide. Many international institutions have played a crucial role in this progress: the World Bank with the Living Standard Measurement Study (LSMS) project, USAID with the Demographic and Health Surveys (DHS) project, UNICEF with the Multiple Indicator and Cluster Survey (MICS) project and in 2003 the World Health Organization (WHO) with the World Health Survey (WHS) project. Now virtually every country in the world has at least one of these surveys being conducted periodically (except WHS, which was a one-time study).

However, there is still a long way to go. The MPI shows a key bottleneck of poverty measurement: the limited amount of internationally comparable data. This restriction applies on three fronts: considered dimensions, international comparability and unit of analysis.

Considered dimensions. There is no multi-purpose survey that collects good quality information on the indicators used in the MPI plus good quality data on some other relevant dimensions such as income or consumption, employment or violence. For example, the DHS have—to date—the best internationally comparable health indicators but no income or expenditure information and limited information on employment. They only contain asset information which is used to construct a wealth index, but this lacks information on the price, functionality, or quality of the asset. On the other hand, the LSMS and household budget surveys provide the best income or consumption modules and good data on employment, but few have good health data or indicators of the quality of education. They sometimes include some questions on access to health facilities, but these are not always collected, and they are indicators of access rather than actual functionings. Some DHS meanwhile collect (imperfect) indicators of empowerment, which are not collected in LSMS.

International comparability. Each country implements variants of internationally standardised surveys. The result is that some countries include some valuable dimensions, but these efforts are only useful for the country-level analysis or for a very limited international comparison. Moreover, further work on standardising the collection of information on key variables, such as water and sanitation, is required to ensure better cross-country comparability. Additionally, to guarantee perfect international comparability, it would be necessary to have these standardised surveys being conducted in the same year throughout the different countries, or at least more frequently.

The limitations relating to dimensions and international comparability explain why some very relevant dimensions of well-being such as empowerment, employment and violence could not be included in the MPI. They also reveal an urgent need for the international community to agree upon a set of valuable dimensions of development and direct all efforts to collect data on them—within the same survey—in order to enable a better multidimensional analysis.

Unit of analysis. To study intra-household inequalities, gender inequalities and age-inequalities, one would need to have individual-level information on every indicator. Individual-level information is usually collected in some surveys for several indicators, such as education, employment and income,

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but not for all. For example, health indicators are usually collected for children under 5 years of age and women in reproductive age.

A further improvement in data collection would necessitate collecting indicators at the individual level. Understandably, limited resources may prevent all improvements being carried out at once, and individual data collection may be a second order improvement. But with the avalanche of new information technologies, vital topics like poverty measurement and analysis should not be so data poor.

Box 4: Some key terms defined

Functionings and basic functionings
"Functionings are defined as "the various things a person may value doing or being" (Sen 1999, p75). In other words, functionings are valuable activities and states that make up people's well-being—such as being healthy and well-nourished, being safe, being educated, having a good job, and being able to visit loved ones. They are also related to goods and income but describe what a person is able to do or be with these. For example, when people's basic need for food (a commodity) is met, they enjoy the functioning of being well-nourished."[15]

"Because functionings are aspects of human fulfilment, some functionings may be very **basic** (being nourished, literate, clothed) and others might be quite complex (being able to play a virtuoso drum solo)."[16]

Multiple deprivations
Those who do not reach the deprivation cut-offs in multiple indicators *at the same time* are said to experience multiple (joint) deprivations.

Incidence
The proportion of people (within a given population) who experience multiple deprivations. This is known formally as the "multidimensional headcount ratio." Example: 80 per cent of people are poor.

Intensity
The average proportion of deprivations experienced by poor people (within a given population). Example: the average poor person is deprived in 50 per cent of the (weighted) indicators.

Deprivation cut-offs
The minimum levels of satisfaction associated with each indicator of the MPI.

Poverty cut-off
This is the cut-off or threshold used to identify the multidimensionally poor. It reflects the proportion of weighted indicators a person must be deprived in to be considered poor.

Alkire-Foster method
This is the method that the MPI follows and that identifies who is poor according to the simultaneous or "joint" deprivations a person experiences, and measures poverty according to its incidence and intensity. The method is flexible and can be used with different dimensions and indicators to create measures specific to different societies and situations.

Multidimensional headcount ratio
This is the formal name for the "incidence" of poverty, i.e. the proportion of people (within a given population) who experience multiple deprivations

Censoring

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[15] Alkire, S and Deneulin, S. 2009. p. 31.
[16] Definition taken from the Human Development and Capabilities Association (HDCA) Briefing Note Alkire, S. "Capability and Functionings: Definition & Justification." Retrieved from their website on 5 August 2011:
http://www.capabilityapproach.com/pubs/HDCA_Briefing_Concepts.pdf

This is the process of removing from consideration deprivations belonging to people who don't reach the poverty cut-off and focusing instead on those who are multidimensionally poor.

Raw headcount ratios
The deprivation rates in each indicator, which includes everyone who is deprived, regardless of whether they are multidimensionally poor or not.

Censored headcount ratios
The proportion of people who are multidimensionally poor *and* deprived in each of the indicators

Decomposition
The process of breaking apart the MPI to show the composition of poverty for different groups. Groups might include countries, regions, ethnic groups, urban versus rural location, or other key household characteristics.

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