

## POVERTY MAPPING: HORSES FOR COURSES?

### 1. OVERVIEW

Our 3 Step Plan to overcome more poverty sooner with the same resources is to: define poverty, map poverty and focus the poverty fixers. Step Two is all about becoming more effective in the area of Poverty Mapping. Not because producing maps of poverty magically alleviates poverty itself, but because (like Step 1), accurate poverty mapping provides a dramatic impetus for progress in step 3: focusing the poverty fixers. This article considers the 7 layer Poverty Model approach to Poverty Mapping alongside other established methods, in their 3 key aspects (measurement, data collection and presentation), evaluating which approach might typically be favoured, for different purposes and in different practical constraint scenarios. Our considered conclusion is not that one is definitively better than another, but that each has a potential role to play as a tool in the 'maptivist' user's kit bag. In short, it's a case of 'horses for courses'.

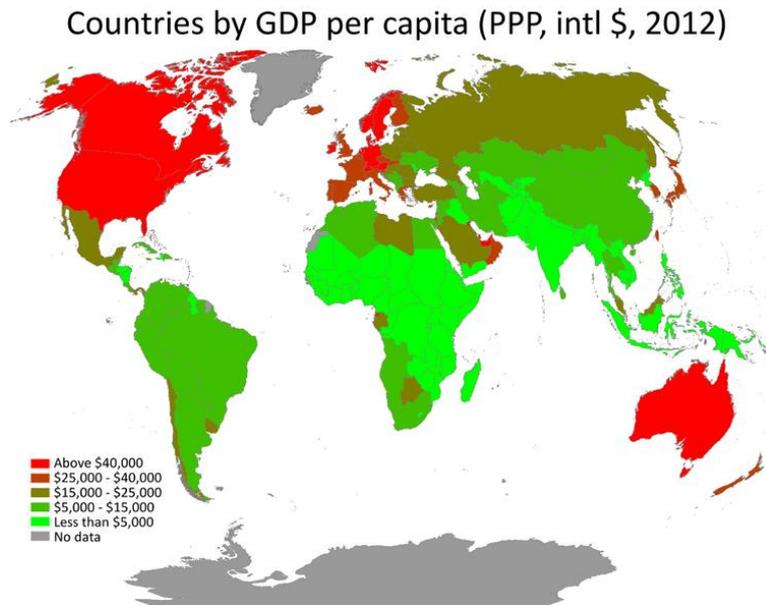


### 2. MEASURE: COLLECT: PRESENT

If you are going to map anything, you need 3 things regarding the variable(s) you aim to study: a suitable system of measurement for the variable(s); a way of gathering accurate source data; and a way of then presenting that data in an appropriate format for your target audience. At 'Give A Billion', our integrated, multi-dimensional system of poverty measurement is provided by the 7 Layer Poverty Model. Our default way of collecting accurate source data is the Simple Assessment survey questionnaire process. Our ideal way of presenting the data is an interactive, online, geographic information system, allowing approved system users to drill all the way down to individual survey responses. However, in the absence of the resources for a fully-featured GIS, simple spreadsheet presentation of data will suffice as a workaround.



We have developed our entire approach from the ground up, using first principles and applied common sense, with a view to practical problem solving – rather like inventors working in our own garage. Now we have a ‘working prototype’, it is reasonable to compare and contrast our own chosen approach with ‘the-best-of-the-best’ among others currently available globally - the aim being to assess the relative merits of each alongside each other. Such comparisons can be made for each of the 3 key Poverty Mapping components of measurement, data collection and data presentation.



### **3. SYSTEMS OF POVERTY MEASUREMENT**

The World Bank is recognised by many (but certainly not all) as the leading global expert institution on poverty and the associated practice of Poverty Mapping. As such, its own web site states: “A common method used to measure poverty is based on incomes, or consumption levels. A person is considered poor if [their] consumption, or income level, falls below some minimum level necessary to meet basic needs. This minimum level is usually called the ‘poverty line’.” It then briefly explains the challenges of comparing and aligning ‘poverty lines’ between countries, based on normalised income purchasing power comparisons, before stating: “For the purpose of global aggregation and comparison, the World Bank uses reference lines set at \$1.25 and \$2 per day (2005 Purchasing Power Parity terms)”, for measuring poverty and extreme poverty respectively. Hence, its primary system of poverty measurement is based on income (PPP), expressed in equivalent daily dollar figures. For various reasons, this has become the most widely-used system of measuring poverty worldwide – and has been for many years. This data is thus the one-dimensional variable data that will typically be used by the World Bank (and others like the UN) as the input into any associated Poverty Mapping process.

However, the World Bank admits an underlying challenge it faces, even when considering just this one poverty measurement variable: “Aggregate, national level indicators often hide important differences between regions, or areas. The analysis of poverty, its determinants and poverty-reducing interventions, therefore requires a focus on poverty information that is further geographically disaggregated.” By disaggregated, they mean broken down relevantly into more

accurate figures for smaller areas and populations than the entire country. For a graphic illustration of why this is important, please do watch the 4 minute video by Hans Rosling referenced on this site, called “200 Countries: 200 Years”. In the latter half, it uses the specific example of China to show how national-level data aggregation hides significant and relevant differences at a regional level within the country. Common sense informs us that you could continue breaking down regional data more and more, to get an increasingly accurate picture of the true state of incomes and poverty ‘on the ground’ at a local community level – if the available underlying statistics permitted it. The ability to do that is ultimately dependent on your methods of source data collection.



#### **4. SYSTEMS OF DATA COLLECTION COMPARED**

The World Bank’s web site explains its own data collection system as follows: “Information on consumption and income is obtained through sample surveys, with which households are asked to answer detailed questions on their spending habits and sources of income.” Sample surveys are so-called, because they make no attempt to get comprehensive data from all potential members of a given target population. Hence, they contrast with something like a Census, or Audit, where the intention might be to get survey participation levels of well over 90%. The operational cost of managing data collection at quite so comprehensive a level, is usually highly prohibitive. Hence, even countries like the USA and the UK will only conduct a comprehensive National Census once every 10 years. They then use this source data, combined with data from other secondary indicators and extrapolate to generate estimates of changes in the data between each Census. One of the ways of cross-checking the relative accuracy of those estimates, is through Sample Surveys, where only a fraction of the total target population is actually measured. Such samples may be for sub-sets as small as 1% or even 0.1% of a given total population.

There are clearly drawbacks to only checking your source data and extrapolation estimates with 1 person out of 1000 or more. Your 1 person in 1000, picked at random, may not prove quite so representative of the other 999 after all. And let’s be honest, exactly how consistent can you ever hope to get when averaging any measurements across 1000 individuals? Imagine if you picked the single measure of height. How valid would you think measuring the height of 1 person in 1000 would be as a valid basis for estimating the height of the other 999? Exactly. It is daft. Everybody knows it is daft, but it is still typically considered better than the other 2 options of:

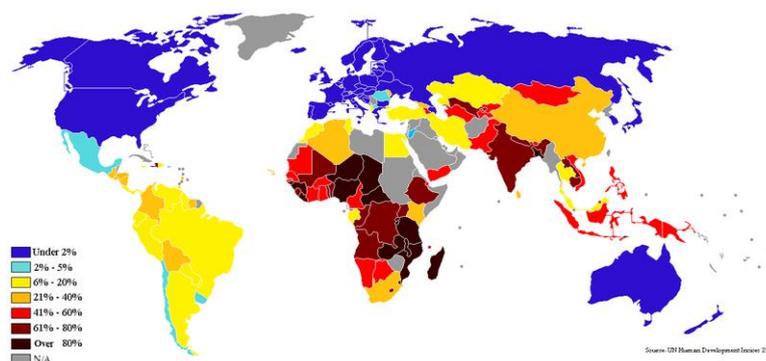
- No sample measurement at all, which would then leave us at the mercy of guesswork, based on original Census snapshot data and secondary indicators of relevant criteria change over time; or
- Comprehensive measurement – which is just way too expensive.

It’s a tricky one, right?

In this article, we are aware that we are simplifying a whole load of statistical techniques and associated jargon, robustly defending the case for accurate statistical extrapolation from Sample Surveys. But just to reassure you we have read some of it, here's a quote from the conclusion of an excellent, foundational article on relevant poverty measurement statistical methods, by Ghosh & Rao (1994), to help you understand WHY we are simplifying the language a little: "To this end, an approximately unbiased estimator of MSE of the EBLUP estimator is given as well as two methods of approximating the true posterior variance, irrespective of the form of the prior distribution on the model parameters." Now then, wouldn't you rather we kept to the simplified language? Yes, we thought you would.



So here is your data collection problem, summarised. Census-type data is great as a snapshot of the way things are at a single point in time, but we all know things change – sometimes rapidly. Plus, it's really expensive to gather data at that level of detail. On the other hand, Sampling techniques keep the costs way down, but then they suffer with a 'margin of error', when used to help extrapolate towards estimates of the entire target population. And actually, this is not just your problem – you have company. It is a problem shared by the World Bank – oh, and just about every other country government, just about everywhere in the world – and just about all the time. In short, we're all guessing, pretty much all the time. Sorry to disappoint you.



However, by way of reassurance, there are some pretty smart people who have come up with some pretty smart statistical methods to help manage the 'margin of error' problem. In short, although they are still guessing, they can get those guesses pretty accurate for much of the time and have a pretty good idea of how close those guesses will work out – usually. The World Bank uses one such approach, called Small Area Estimation. In case the word does not translate well for some of our non-English speaking readers, "estimation" is another word for "calculated guess". I imagine when they had the meeting to decide what to call this approach, "calculated guesswork" didn't get as many votes. Shocker.

But perhaps we are being too harsh. We absolutely agree that calculated estimates are better than no data at all, except where that estimated data ends up giving you a dangerously misplaced sense of confidence that you have an accurate insight into the real situation. In that case, to “know that you don’t know” may be a safer mindset for policy-making, than to blindly believe in the accuracy of “guesstimates”. We are not alone in advising such caution. As Schaible (1992) puts it: “Indirect estimators should be considered when better alternatives are not available, but only with appropriate caution and in conjunction with substantial research and evaluation efforts. Both producers and users [of the data] must not forget that, even after such efforts, indirect estimates may not be adequate for the intended purpose.”



SAE’s then, are adopted as a substitute for direct, Census/Audit-type measurement. They will often be based on original measurement data, such as a Census, then supplemented by other data from other change indicator sources (births, deaths, economic statistics etc) and more comprehensive Sample Surveys – particularly to do with sample population income and spending patterns. This is politely referred to as “borrowing strength” from other data sources. By implication, this is necessary to bolster up what would be ‘weaker’ data otherwise. Here is what Ghosh & Rao (1994) say about it:

“SAE is becoming important in survey sampling due to a growing demand for reliable small area statistics...It is now widely recognised that direct survey estimates for small areas are likely to yield unacceptably large standard errors due to the smallness of sample sizes in the areas.”

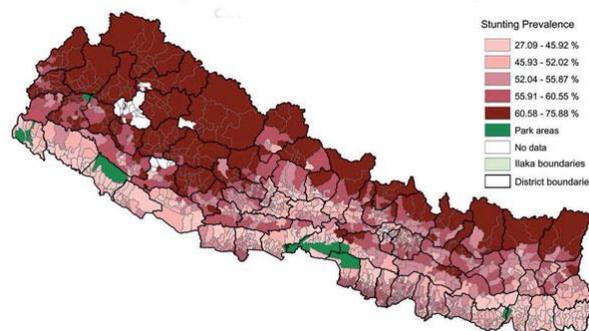
This means that the sample survey data typically collected works out ok for averaging across large populations, but policy decision-makers increasingly need more detailed data down to lower levels in any target population, or area. This is called ‘granularity’. In summary, the closer you can get to data for each specific individual, the better the level of ‘granularity’ in your data. The idea is based on sizes of things like grains of sand. Grains, hence ‘granular’. Going the opposite way, you get data for lots of people all being lumped in together and averaged. This is called ‘aggregation’. So where you want to de-lump a whole load of data that is all stuck together, it is called ‘disaggregation’. Got it? Good.

The reasons for the modern drive towards techniques like SAE are said to be twofold:

Firstly, “increasing government concern with issues of distribution, equity and disparity” (Brackstone, 1987). Secondly, the cost problem we mentioned earlier: “For the past few decades, sample surveys, for most purposes, have taken the place of complete enumeration, or census as a more cost-effective means of obtaining information on wide-ranging topics of interest at frequent intervals over time.” (Ghosh & Rao, 1994). They go on to explain that SAE arose to satisfy the

conflicting demands of more accurate and reliable projections, drawn from available data, but in a cost-effective manner, saying: “Demands of [this type] could not have been met without significant advances in statistical data processing. Also, development of some powerful statistical methods, which “borrow strength” from related, or similar small areas, through explicit or implicit models that connect the small areas via supplementary data.”

Others in the world of statistical academia have investigated the relative reliability of SAE techniques. For example, Christiaensen et al, June 2011 concluded: “This study analyses the performance of poverty prediction models based on small area estimation techniques. Predicted poverty estimates are compared with directly observed levels in two country settings where data comparability over time is not a problem. Prediction models that employ either non-staple food or non-food expenditures, or a full set of assets as predictors, are found to yield poverty estimates that match observed poverty well. This offers some support to the use of such methods to approximate the evolution of poverty.” It should be noted that this report is quoted on the World Bank web site itself, so it is perhaps no surprise that the report backs the World Bank’s own adopted position on using SAEs.



However, such support for SAE’s, in the absence of some better alternative, is not isolated. Consider the joint World Bank and Nepal Central Bureau of Statistics study, called: “Nepal: Small Area Estimation of Poverty, 2011”. It was published in 2013. It concludes: “An advanced and cost effective statistical technique called Small Area Estimation (SAE) proved to be a boon for Nepal. This method gives estimates of poverty for smaller areas by mixing the latest results of living standard surveys and Population Census.” The need for such a solution was driven by the same, classic twofold problem: the demand for the greater granularity of data down to smaller geographic levels and the high cost of conducting the surveys to get that level of data detail. The Nepal report states: “The demand for poverty estimates for administrative regions smaller than an analytical domain is increasing, but implementing a sample survey which provides estimates at this great detail is prohibitively expensive.”

## 5. NECESSITY IS THE MOTHER OF INVENTION: BUT WHAT CHILD HAS SHE CONCEIVED?

The World Bank does recognise certain limitations to its traditional measurement and data capture approaches - or at least it recognises a trend towards including supplemental alternatives to its traditional approaches. It states: “While much progress has been made in measuring and analysing income poverty, efforts are needed to measure and study the many other dimensions of poverty... assembling comparable and high-quality social indicators for education, health, access to services and infrastructure...[including] developing new indicators to track other dimensions -- for example

risk, vulnerability, social exclusion, access to social capital -- as well as ways to compare a multi-dimensional conception of poverty, when it may not make sense to aggregate the various dimensions into one index." All these known issues are factors addressed by the 7 Layer Poverty Model approach and the Simple Assessment data collection technique. As we stated earlier, we have developed the Model from first principles of complex problem solving and applied common sense, so the fact that the World Bank (with all its significant global resources) has officially arrived at similar conclusions on these matters, is somewhat reassuring.



They further state: "These sample survey data collection methods are increasingly being complemented by participatory methods, where people are asked what their basic needs are and what poverty means for them. Interestingly, new research shows a high degree of concordance between poverty lines based on objective and subjective assessments of needs." The Simple Assessment would qualify under its label of a "participatory" survey technique. Hence, what they are saying, is that if you ask people about the nature of the poverty conditions they face, they can tell you – and it seems to match the World Bank's income-based poverty line prediction measures fairly closely, in their view.

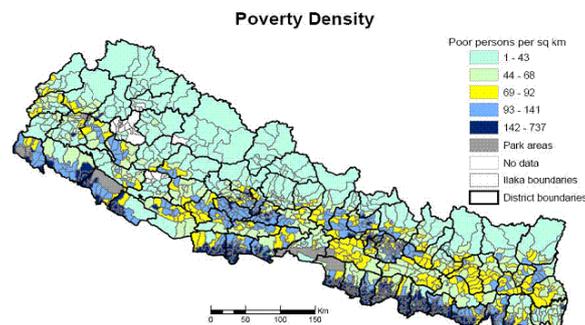
They conclude: "In addition to expanding the range of indicators of poverty, work is needed to integrate data coming from sample surveys with information obtained through more participatory techniques, which usually offer rich insights into why programs work, or do not. Participatory approaches illustrate the nature of risk and vulnerability, how cultural factors and ethnicity interact and affect poverty, how social exclusion sets limits to people's participation in development, and how barriers to such participation can be removed."

Thus, it seems, the World Bank officially recognises the need for, and benefits of, the approach to Measuring Poverty adopted within the 7 Layer Poverty Model, together with our proposed method of gathering the relevant data by Simple Assessment, which might qualify under their 'participatory technique' label. So we choose to infer a sense of high-level endorsement, that we are on the right lines here – or at least, that others recognise the data capture problem that we ourselves have identified, within Step 2 of our 3 Step Plan to overcome poverty: Poverty Mapping. Suitably encouraged in our efforts, we now move on to consider Data Presentation.

## **6. PRESENTATION OF THE DATA**

The Nepal Poverty map study mentioned above, explains the great appeal of producing a comprehensive poverty map, for wider public consumption: "Visualized on geographical maps, small area estimates can convey to audiences of all literacy levels, the scale and distribution of poverty not

possible by tabular data. Further, poverty maps can be super-imposed on spatial variables such as climate, or infrastructure, to analyse spatial determinants of poverty.”



We have referred elsewhere on this site ([www.giveabillion.net](http://www.giveabillion.net)), to the Transparent Chennai poverty mapping project. This is a compelling, real-life illustration of using data to inform action by poverty fixers. In that specific case, the fixer identified was primarily the relevant local Indian Government city authorities. Our anticipated application is broader – and global. Also, they required a large group of volunteers and some skill in manipulating the data to ultimately present it as maps. A map is a thing of representational beauty. As the Nepal study showed, it is accessible to all kinds of literacy levels and is far easier for stakeholders to understand, interpret and digest, than tables of data.

While we are happy with static maps as a default method of poverty data Presentation, our own ambition is an interactive GIS, which permits the representation of data down to individual GPS co-ordinates and stored over time. In the absence of such a system, one can still use Excel spreadsheets filled with the relevant data and integrate them within a relevant base map, even using commercial-off-the-shelf products like Esri Maps for Office, or equivalent tools, where available.

## 7. CONCLUSION

The World Bank is considered the primary advisor on poverty and poverty mapping to the UN. Now THAT’S power. They recognise the need for poverty mapping down to a more granular level, advocating the merits of participatory techniques in their own experience. They make no specific case, to our knowledge, for a global GIS and their output tends to default to static snapshot maps, based on one-time data. These are perhaps sufficient for their perceived current needs and audience. Our own ambitions and recommendations extend further, to a full-blown GIS, permitting interactive drill-down to the individual survey respondent’s answers, if necessary – and comparisons over time. In our view, if such a solution was commercially available, it would dramatically accelerate progress to overcome poverty by the many and various poverty fixers active around the world.

So then, we have put the basic tools out there to assist with Poverty Mapping, using the 7 Layer Poverty Model. You just need to use them, or pass them on to others who can – to create their own spreadsheets, poverty maps, or even a poverty mapping GIS, where resources permit. We deal in terms of mainstream products, widely available, to facilitate easy adoption and adaptation. Failing that, it’s back to pencils and notebooks, tracing paper and some colouring pens. Whatever gets the job done, with the resources you have at your disposal. It only takes that, answering 21 questions and some simple maths - and you are on your way to helping overcome global poverty using Poverty Mapping. And that’s a big “Hooray” for us ‘maptivists’!