Small Area Indices of Multiple Deprivation in South Africa

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Small Area Indices of Multiple Deprivation for South Africa

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Abstract

Although the multidimensional nature of poverty has received increasingly prominent attention in academic and policy debate in South Africa during the last decade, there remain few existing attempts at moving beyond the conventional, unidimensional money-metric approach to poverty measurement. This paper provides an outline of the recent development and application of small area level indices of multiple deprivation for South Africa using census data. Multiple deprivation is defined as an accumulation of discrete dimensions of deprivation. The principles adopted in conceptualising the indices are described, together with a discussion of the results, ongoing processes of refinement, and the potential uses of these tools empirically and for policy making at both national and regional levels.

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1. Introduction

It is important for governments, aid agencies and non-governmental organisations to be able to accurately identify and target the most deprived areas in order to help them meet some of the United Nations Millennium Development Goals (MDGs), and to constantly refine the targeting of interventions contained in Poverty Reduction Strategy Papers (PRSPs) and other programmes. Good quality detailed information on a number of different issues, including income poverty, health, education and access to services is vital for these efforts.

Since the beginning of the post-apartheid era, a key objective of the South African government has been the improvement of the quality of life of all South Africans and the reduction of poverty and social inequality (Republic of South Africa, 1994; African National Congress, 2004). The South African constitution requires the government to ensure that financial resources are distributed equitably among provincial and sub-provincial governments, based partly on levels of poverty and disadvantage (Alderman et al., 2003). In order to fulfil this requirement, robust measures are needed that quantify the nature and extent of social deprivation at sub-national level and thereby accurately identify the areas of greatest need (i.e. the most deprived areas).

In 2000, Statistics South Africa released a report which stated that in addition to thinking about poverty in terms of levels of income and expenditure, there is also a need to consider poverty more broadly: 'It is seen as the denial of opportunities and choices most basic to human development to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-esteem and respect from others' (Statistics South Africa, 2000: 54). The measurement of poverty and inequality and the changing nature of these phenomena over time has been the subject of much debate in recent years (Roberts, 2004; Bhorat and Kanbur, 2006; Meth, 2007; Noble et al., 2007b). There has been much conceptual and analytical progress, and a proposal has been made for an official national money-metric poverty line for the country (Statistics South Africa and National Treasury, 2007). However, while there appears to be a general consensus about the multidimensional nature of poverty (Lipton and Maxwell, 1992; World Bank, 2000; Maxwell, 2003), very few attempts have been made to produce indices of multiple deprivation compared to money-metric approaches to measuring poverty.

The objective of creating an index (or indices) to measure deprivation at the local level, to identify priority areas and target programmes more effectively has been a consistent feature of government policy in many developed countries since the 1960s (Noble et al., 2006b) but is only beginning to be introduced in developing countries. Recent work in South Africa is a prime example.

The purpose of this paper is to provide an outline of the development and application of small area level indices of multiple deprivation for South Africa. This paper gives a a brief review of current approaches to measuring small area deprivation in developing countries and previous research in South Africa in this area (section 2). The model of multiple deprivation that was used in the South African work is described (section 3) and the statistical techniques used to operationalise the model are discussed (section 4). The geography of deprivation for two example provinces is then explored (section 5). The potential and actual uses of these tools empirically and for policy making both at national and regional levels are presented (section 6). Finally, future developments of the index work - a new statistical geography, new data sources and extending the work to other African countries - are highlighted (sections 7 and 8).

2. Current approaches to small area poverty and deprivation measurement in developing countries

Most work on small area poverty measurement in developing countries focuses on income and/or expenditure patterns. It also tends to ignore the multidimensionality of deprivation which is now recognised in both the Copenhagen Declaration (United Nations, 1995) and the United Nations MDGs. Although there are a few examples of a multi-indicator approach to measuring deprivation in developing countries, these tend to lack a strong theoretical underpinning and coherent methodological approach.

Approaches to small area poverty and deprivation measurement and mapping in developing countries can be divided into three main categories: small area estimation of income/expenditure at the household or community level; multivariate basic needs indices; and applications of the Human Development Index (HDI) at sub-country level (Henninger and Snel, 2002). These are described below with particular reference to South African studies[5].

2.1 Small area estimation

The World Bank pioneered the expenditure based small area estimation techniques using household unit data (e.g. Ghosh and Rao, 1994; Hentschel and Lanjouw, 1996; Elbers et al., 2003). Small area estimation is a statistical inference technique that allows estimation for small areas, by combining information from Censuses and household surveys. Commonly, this approach uses nationally representative income/expenditure surveys and household censuses to produce estimates of households falling below an expenditure poverty line and has been used by the World Bank and partners in a number of countries (e.g. Hentschel and Lanjouw, 1996; Alderman et al., 2000; Benson, 2002; Alderman et al., 2003; Demombynes, 2005). The approach has also been undertaken using community level averages (Bigman et al., 2000; Bigman and Fofack, 2000; Minot, 2000). In South Africa, Alderman et al. (2000) combined the 1995 Income and Expenditure Survey, the 1995 October Household Survey and the1996 Census to construct estimates of household expenditure. Households with expenditure below the threshold set by the Department of Local Government were deemed to be living in poverty. The results yielded estimates of the proportion of households living in poverty at various geographical levels, although with declining precision for small sub-units of major administrative divisions.

In addition to small area poverty measurement and mapping, there are a number of mapping studies that focus on particular types of deprivation, for example food security (e.g. Drimie et al., 2005). Several of these studies have adopted the World Bank's estimation method in mapping local level deprivation.

An advantage of small area estimation approaches is the availability of statistical techniques that can be applied to producing an estimate of poverty derived from household level data (often per capita consumption or other additional variables such as malnutrition). A potential weakness is that the result is an *estimate* only, and not a direct measure. The assumption in making this estimate is that the associations found in the national survey will hold across all areas in a consistent form. This is unlikely to be the case: although the estimates overall will have a fairly high level of precision, there is likely to be bias in some areas. Thus, to build local measurement

[5] For a more in depth review of studies in South Africa which seek to measure deprivation at the small area level see Noble et al., 2006a.

purely on small area estimation could be misleading in some areas and it has been argued that small area estimation may not necessarily be a 'gold standard' technique (Davis, 2003).

Moreover, small area estimates result in a unidimensional picture of poverty - usually estimates of the proportion of the population falling below an expenditure or consumption-based poverty line. If a multidimensional picture was required, such small area estimation would need to be repeated for each dimension of deprivation.

2.2 Multidimensional small area indices of deprivation[6]

A small number of countries have used multidimensional small area indices of deprivation (see Davis, 2003). These tend to use variables from the census that are associated with underdevelopment, and combine these using data reduction techniques such as principal components analysis or factor analysis. Hirschowitz et al. (2000) constructed provincial level 'development indices' for South Africa. Average monthly household expenditure was joined by ten indicators from the 1996 Census in a factor analysis. Two indices were identified: a 'Household Infrastructure Index' and a 'Household Circumstances Index'. The Infrastructure Index was based on eight variables relating to the state of housing, access to services, education and expenditure. The Circumstances Index was based on the remaining three variables relating to unemployment, household size and number of children. Other small area multidimensional approaches employed in South Africa include McIntyre et al.'s (2000; 2002) four deprivation indices which focused on the relationship between deprivation and health inequalities. These were constructed at magisterial district-level using the 1996 Census and principal components analysis was used in two of the indices.

These approaches do have the advantage of moving small area deprivation measurement into the multidimensional arena and encompass a far wider range of indicators of social deprivation and inequality than those analyses restricted to measuring income, expenditure or consumption alone. However, they tend to be empirically rather than theoretically driven and do not address the literature relating to multiple deprivation. The Hirschowitz et al. indices, for example are not an articulation of any explicit model of multiple deprivation; five of the eleven variables entered into the factor analysis relate to access to services, while the remaining six relate to housing, education, employment, expenditure and household demographics. This results in far greater weight being given to the issue of access to services than to the other aspects of social disadvantage.

2.3 Applications of the Human Development Index

In some areas the United Nations Development Programme HDI has been produced at sub-country level (e.g. Henninger and Snel, 2002; Department of the Premier of the Western Cape, 2005). The national HDI is a combination of measures of life expectancy, education and per capita GDP. The HDI is not held out to be a measure of multiple deprivation and it does not conform to a rigorous conceptual model of multiple deprivation. Though it could be considered to be a crude instrument that has ensured that non-income dimensions of wellbeing feature in poverty debate, it has

[6] Multiple deprivation has been explored in the South African context by various researchers, for example Klasen's deprivation index (1997; 2000), Vichi's index of deprivation (1997), and the South African Advertising Research Foundation's Living Standards Measure (e.g. Van Aardt, 2005), but these have not been produced at the small area level.

been critiqued variously for its choice of components, weighting approach, estimation protocol, and aggregation rules (Ravallion, 1997; Klasen, 2000).

The Social Research and Population Development Unit of the Department of Health and Social Services in the Western Cape, South Africa, created an HDI specifically for the Western Cape province (Department of Health and Social Services of the Western Cape, 1999). Terming their index a 'Provincial Human Development Index' the Unit combined four indicators with equal weight to form a composite index. These four indicators - income, employment status, literacy and water supply - were each formed from one or more variables from the 1996 Census. The four indicators were constructed independently and combined with equal weight. This work has been further developed (Department of the Premier of the Western Cape, 2005) using the 2001 Census to produce an HDI at municipality level. This combines variables relating to a long and healthy life (life expectancy) with variables relating to 'knowledge' (adult literacy and gross school enrolment) and a decent standard of living (using mean household income). The 2005 work also involved the generation of a set of indices which were combined to form a 'City Development Index' (CDI), also largely based on the 2001 Census. The CDI is a combination of education, infrastructure, health, income and waste removal indices, and is presented at census main place level. However, this approach measures human development relevant to urban populations rather than multiple deprivation at small area level.

Noting the shortcomings in the current measures of poverty and deprivation in South Africa, an index of multiple deprivation was constructed for each of the nine provinces in South Africa at ward level using the most recently available Census of Population (2001), and was published in March 2006 as the Provincial Indices of Multiple Deprivation 2001 (PIMD 2001) (Noble et al., 2006a). These indices draw conceptually and methodologically on work undertaken in constructing national indices of deprivation at small area level for the UK (Noble et al., 2000a; 2000b; 2001; 2003; 2004; 2005; 2008). In England, a national index of multiple deprivation at the local level was first developed in the 1980s, facilitated by the publication of the decennial Census of Population in electronic form with data available for small geographical areas. Advances in the collection and use of other data sources, such as administrative data, have allowed analysis of deprivation at small area level in the inter-censal period. A methodology has been developed for this purpose and is now widely accepted within the UK government.

3. Conceptual framework

Creating measures of multiple deprivation at the small area level is not simply a case of searching for indicators of deprivation and combining them in an ad hoc way. First, there should be a model of small area deprivation which is underpinned by a clear conceptual framework.

The PIMD 2001 and its international predecessors follow in the path of a strong tradition internationally which considers deprivation as unmet needs across different aspects of social and economic life (Townsend, 1979; 1987). Townsend distinguishes between social and material deprivation and lays down the foundation for articulating multiple deprivation as an accumulation of single deprivations, a formulation which is the starting point for the model of small area deprivation. It is possible to measure single deprivations, such as health deprivation or education deprivation at an area level and state that a certain proportion of the population experiences one type of deprivation or a proportion experiences some other form of deprivation, and at an area level describe the combination of single deprivations as

area level multiple deprivation. Multiple deprivation, we argue, is not a separate form of deprivation; it is simply a combination of specific forms of deprivation. The area can be characterised as deprived relative to other areas, in a particular dimension of deprivation, on the basis of the proportion of people in the area experiencing the type of deprivation in question. The area itself is not deprived, but the presence of a concentration of people experiencing deprivation in an area may give rise to a compounding deprivation effect, measured by reference to those individuals. Income deprivation is a central component of the definition of multiple deprivation, but should not be the only measure of area deprivation as other dimensions contribute important additional information about an area. In the PIMD 2001, deprivation is conceived in a broad way, by taking into account issues relating to income, employment, health, education and the quality of the environment in which people live.

A second fundamental principle when creating small area indices is that the methodology selected must be able to put the conceptual model into operation. Once a clear model is developed, data to provide indicators for the dimensions of deprivation should be found, and statistical techniques which are consistent with the model should be utilised. An index should be neither driven by available data nor by statistical techniques.

Measuring different aspects of deprivation and combining these into an overall multiple deprivation measure raises a number of questions.

1. If multiple deprivation cannot be *directly* quantified then how can an overall multiple deprivation measure be validated? The weighting of components in the overall multiple deprivation measure is therefore important, as will be discussed below.
2. To what extent does deprivation in one dimension cancel out deprivation in another? The model is essentially a weighted cumulative one with an argument for limited cancellation effects.
3. To what extent can the same people or households be represented in more than one of the dimensions of deprivation? The position taken is that if an individual, family or area experiences more than one form of deprivation, this is worse than experiencing only one deprivation. Double counting between domains is therefore appropriate in order to identify that they are deprived in more than one way.

In summary, the model that has been developed and applied to the PIMD 2001 is a series of uni-dimensional domains of deprivation which may be combined, with appropriate weighting, into a single measure of multiple deprivation[7].

4. Methodology

Taking the conceptual framework outlined above, a methodology has been developed to construct a small area level index of multiple deprivation. Various steps have to be taken to construct an index using this methodology[8]:

1. *Decide on the spatial scale* - There was general consensus that each PIMD should be constructed at the smallest workable spatial scale and that the ideal geography should have relatively even sized populations. At a sub-provincial

[7] A more detailed account of the conceptual framework underpinning the PIMD 2001 and previous small area deprivation indices can be found in Noble et al. (2006b).
[8] A more detailed account of the methodology used in the PIMD 2001 can be found in Noble et al. (2006a).

level, there were various options for the geography for the PIMD, including municipalities, main places, sub places and wards[9]. Wards have the least diversity in population size[10]; they give a neater geography than main places or sub places as they are contiguous; they nest within municipalities; and the boundaries change little over time[11]. As such, the ward was selected as the main unit of analysis. There are 3 799 wards in South Africa[12].

2. *Decide on appropriate domains of deprivation and indicators for each domain* - After a series of discussions with experts in the field and among the research team, a number of domains or dimensions of deprivation were identified as important in the South African context. Five of these domains of deprivation were identified that could be constructed using the 2001 Census: income and material deprivation, employment deprivation, health deprivation, education deprivation and living environment deprivation. One of the main dimensions identified which could not be measured at ward level using either the Census or administrative data was the incidence of crime. Work continues to construct such a dimension for future indices. Each domain is presented as a separate domain index reflecting a particular aspect of deprivation. The goal for each domain was to include a parsimonious collection of indicators that comprehensively captured the deprivation for each domain, but within the constraints of the data available from the Census. Three further criteria were kept in mind when selecting indicators: they should be 'domain specific' and appropriate for the purpose (as direct as possible measures of that form of deprivation); they should measure major features of that deprivation (not conditions just experienced by a very small number of people or areas); and they should be statistically robust.

3. *Combine indicators into domains* - For each domain of deprivation the aim is to obtain a single summary measure whose interpretation is straightforward in that it is, if possible, expressed in meaningful units (e.g. proportions of people or of households experiencing that form of deprivation). Apart from the health deprivation domain, all of the other domains were created as simple rates. This avoided the key issue of weighting indicators which is necessary when combining indicators into a single measure. Because the domain scores are rates they are easy to interpret (i.e. X% of people in the ward of the relevant age are experiencing this type of deprivation). The health deprivation domain was more complex as it had to be age standardised and the technique of shrinkage estimation[13] was applied to ensure robustness. Every ward within a province was assigned a score on each domain, after which the scores were standardised by ranking, providing a relative picture of each dimension of deprivation in each province. The domain deprivation measures were then combined into an overall multiple deprivation measure.

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[9] There are several paths to the hierarchical structure of the Census geography, two of which are: South Africa→province→ district council or metro→muncipality→main place→sub place and South Africa→province→district council or metro→muncipality→electoral ward.

[10] Although as will be discussed later, there is still considerable variation in ward size.

[11] An important consideration for measuring change in levels of deprivation over time.

[12] District Management Areas and fragments of those wards split between province boundaries where the population was less than 100 were eventually omitted from each PIMD.

[13] Shrinkage estimation (i.e. empirical Bayesian estimation) is a technique that can be applied to a score to deal with unreliability due to large standard errors. The effect of shrinkage is to move the score for a small area towards the average score of a larger area, for example moving a ward score towards the average score for the municipality in which the ward is located. The extent of movement depends on the reliability of the indicator and the heterogeneity of the larger areas. A robust score will move a negligible amount as it is related to the standard error. Areas may become more or less deprived depending on their deprivation score in relation to the municipality mean.

4. *Combine domains into an overall index* - This involves three key processes, namely standardisation, transformation and weighting.

   Standardisation - The domain indices were standardised by ranking the scores in each domain.

   Transformation - The domain indices were then transformed to an exponential distribution. The exponential distribution was selected for three main reasons. First, it transforms each domain so that they each have a common distribution, the same range and identical maximum/minimum value, so that when the domains are combined into a single index of multiple deprivation the (equal) weighting is explicit. Second, it is not affected by the size of the ward's population. Third, it effectively spreads out the part of the distribution in which there is most interest; that is the most deprived wards in each domain. When transformed scores from different domains are combined by averaging them, the skewness of the distribution reduces the extent to which deprivation on one domain can be cancelled by lack of deprivation on another. The exponential transformation that was selected for standardising the domains in the ward level PIMD stretches out the most deprived 25% of wards in each province. The actual distribution employed is one of a family of similar distributions. In the UK indices, the most deprived 10% of wards are stretched out, but in South Africa, with much higher levels of deprivation it was thought that it was appropriate to spread out the most deprived quarter of the distribution.

   Weighting - In order to combine the domains, a weight - a measure of the importance of the component - has to be attached to each domain. There are various ways of determining weights: theoretical, empirical, policy-driven, consensual (i.e. through consultation), or arbitrary. These have been explored in some detail in Noble et al. (2004) and Dibben et al. (2007) The theoretical approach, where the available research evidence is reflected in the weights selected, was used in the English Indices of Deprivation 2004 (ID 2004) (Noble et al., 2004). It was argued that the academic literature, in combination with the research team's work and a consultation process, suggested that the income and unemployment domains were the key contributors to multiple deprivation and so should carry greater weight than the other domains. The set of weights used in the ID 2004 have since been subjected to sensitivity analysis by comparing them to weights derived from a survey approach, a revealed preference approach and a discrete choice experiment (Dibben et al., 2007). It was concluded that how people actually experience deprivation and social exclusion are closely aligned with the aspects of deprivation which people think are important to tackle and where the government invests money, and furthermore, the average of these three approaches gives weights that are very similar to the theoretically derived weights used in the ID 2004, although health deprivation may have been given too low a weight, while employment deprivation may have been given too high a weight. However, altering the weights to reflect this does not lead to a significant change to the overall index.

   Weighting always takes place when elements are combined together: even summing the domains together means they are given equal weight. For each PIMD, equal weights were assigned to the exponentially transformed domains in the absence of evidence in the South African context suggesting differential weights should be used.

This process resulted in each ward within each province being given a score and a rank for the overall measure of multiple deprivation (the PIMD). In addition there are five domain measures, which each have a score and rank[14]. The domain and overall PIMD ranks show how a ward compares to all the other wards *within* the province and are easily interpretable.

Provinces with large wards will tend to be under-represented in national indices of deprivation. Due to the variation in ward-sizes between provinces - for example, a mean of 5 000 in the Northern Cape compared to 20 000 in Gauteng - this ultimately led to the choice, for the PIMD, of constructing indices that facilitate intra-provincial comparisons rather than allowing comparison across provincial boundaries. This issue is discussed further in section 7.

Bearing in mind the pressing challenge of child poverty in the country, a further extension of this work has been the development of the South African Index of Multiple Deprivation for Children 2001 (SAIMDC 2001) (Barnes et al., 2007b). The SAIMDC, although based on the same conceptual model and methodology as the PIMD, differs in three main ways. First, the domains and indicators focus specifically on children rather than simply treating children as elements of the household or family. Second, due to restrictions on the use of the full Census, the index was produced at municipality rather than ward level using the 10% sample of the Census. This gives a less fine-grained picture of deprivation than is possible using wards. Third, the index is a ranking of municipalities across South Africa, rather than by province.

5. The geography of deprivation: Western Cape and Eastern Cape provinces

The PIMDs provide many useful tools for examining the geographical distribution of deprivation within each province in South Africa. However, it should be remembered that even the least deprived areas may contain deprived people within them and the most deprived areas may contain some affluent people. Furthermore, even where an area is not considered deprived, if it is large in size, it may still contain higher numbers of deprived people than in a smaller area that is classified as more deprived.

Brief analysis of two of the PIMDs - the Western Cape[15] and the Eastern Cape[16] - is presented below. These two provinces are of interest because they represent extremes of deprivation, the Western Cape at the less deprived end of the spectrum and the Eastern Cape at the more deprived end. The Eastern Cape contains two of the former homeland areas created during the apartheid era, the Ciskei and the Transkei.

5.1 Western Cape

It is a feature of all the PIMDs that the most highly deprived wards overall score as deprived on several of the domains. If one takes wards that are ranked overall in the most deprived 25% of the Western Cape PIMD, the following pattern emerges:

[14] A key goal of the project was to make the data domain measures (ranks) and SAIMDC (scores and ranks) publicly available. The data can be downloaded from http://www.casasp.ox.ac.uk/imd.html or http://www.hsrc.ac.za/Research_Programme-Page-64.phtml.
[15] The province to the south-west of the country containing Cape Town.
[16] The province to the east of the Western Cape containing Port Elizabeth, East London and Mthatha.

- 100% are in the most deprived 25% on one or more domains;
- 96% are in the most deprived 25% on two or more domains;
- 87% are in the most deprived 25% on three or more domains;
- 51% are in the most deprived 25% on four or more domains;
- 7% are in the most deprived 25% on all five domains.

There are six wards in the most deprived 25% on all five domains. Of these, three are in George and one each in Witzenberg, City of Cape Town and Prince Albert municipalities. The high incidence of deprived wards in just a few municipalities is again illustrated by Table 1 which presents the most deprived 20 (of 332) wards in the Western Cape, as well as the population size of each of these wards. It is apparent that the City of Cape Town's wards are much larger in terms of population than those of wards in other municipalities. Therefore, as noted above, the actual numbers experiencing deprivation in the 20th most deprived ward (located in the City of Cape Town municipality) may be much greater than , for example, the numbers experiencing deprivation in the second most deprived ward (located in Witzenberg municipality)[17].

Table 1: Most deprived wards in the Western Cape

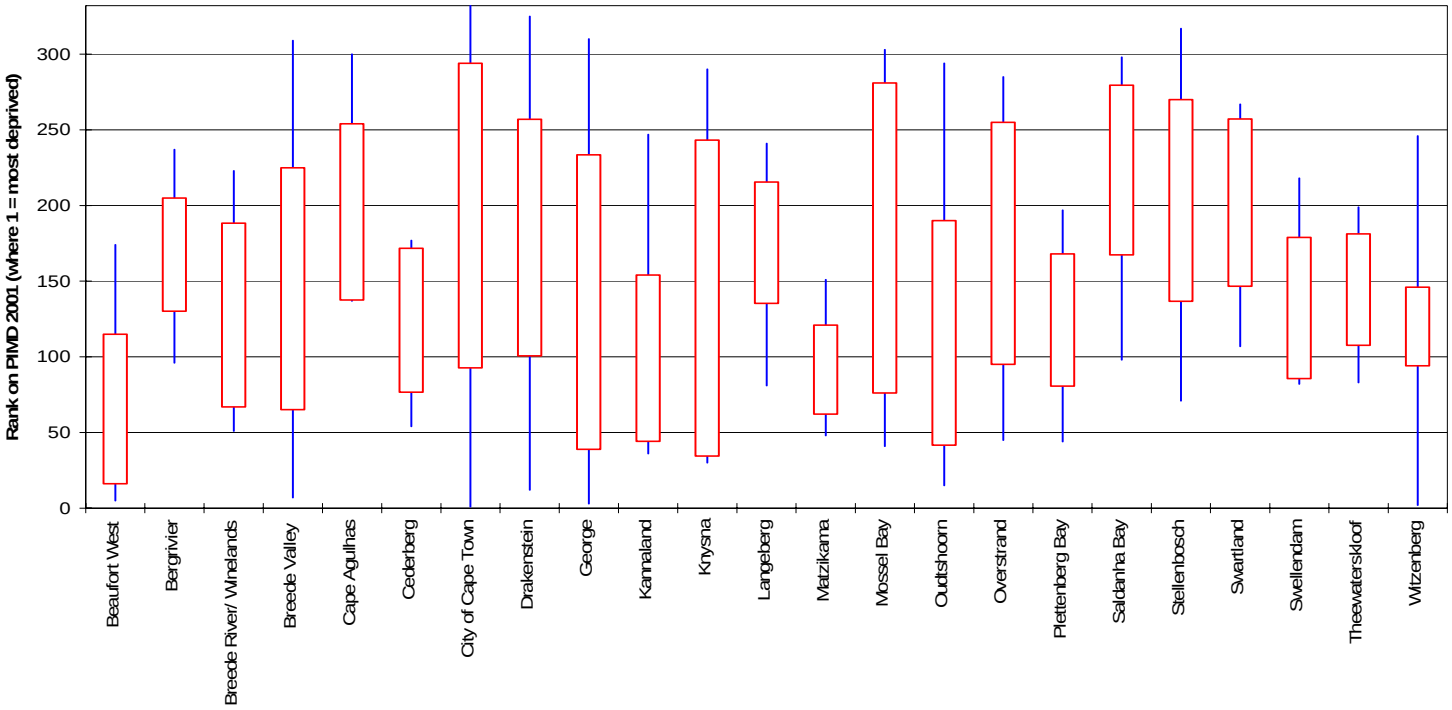
	Ward code	Municipality name	Population in 2001 to nearest 1000	PIMD score
1	19100090	City of Cape Town	32 000	420.40
2	10202001	Witzenberg	7 000	413.69
3	10404014	George	4 000	409.00
4	10404015	George	6 000	398.70
5	10503006	Beaufort West	6 000	389.62
6	19100039	City of Cape Town	18 000	382.54
7	10205018	Breede Valley	7 000	381.64
8	19100034	City of Cape Town	28 000	376.50
9	19100037	City of Cape Town	16 000	376.28
10	19100091	City of Cape Town	27 000	373.65
11	10205002	Breede Valley	8 000	372.75
12	10203023	Drakenstein	5 000	372.56
13	19100093	City of Cape Town	27 000	369.95
14	10404003	George	6 000	367.35
15	10405003	Oudtshoorn	9 000	363.22
16	10503007	Beaufort West	5 000	357.44
17	10502000	Prince Albert	10 000	352.96
18	19100035	City of Cape Town	26 000	352.75
19	19100036	City of Cape Town	26 000	352.69
20	19100098	City of Cape Town	25 000	345.37

In Figure 1 (and Figure 3 for the Eastern Cape) the range of multiple deprivation in a municipality for each ward - as measured by the ward level PIMD - is illustrated by the vertical line. For Figure 1, a rank of 1 is given to the most deprived ward on the PIMD, and the least deprived ward is given a rank of 332. The box indicates the range of the middle 50% of wards in each municipality (the interquartile range). If the box is relatively short this indicates that wards are concentrated in a narrow range (e.g. Matzikama). If the box is located towards the bottom of the chart it tells us that

[17] This can only be determined by looking at the raw scores on individual domains however.

wards in the municipality are concentrated in the most deprived part of the provincial distribution (e.g. Beaufort West). If the box sits towards the top of the chart it tells us that wards are concentrated in the least deprived part of the provincial distribution (e.g. Saldanha Bay).

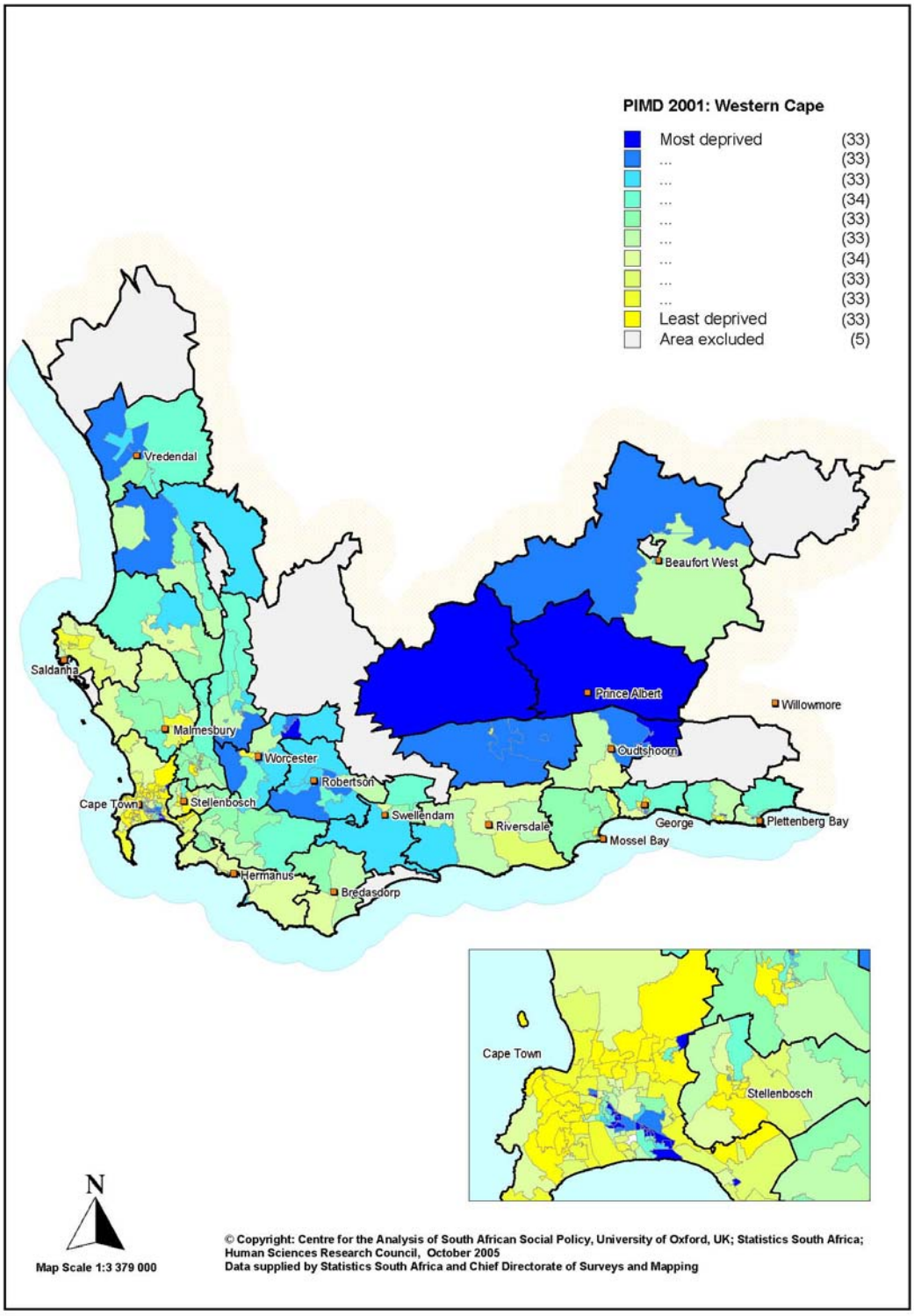
Figure 1: Western Cape PIMD 2001 – the interquartile range



The middle 50% of wards in Matzikama and Witzenberg municipalities are concentrated in a narrow range and towards the most deprived end of the distribution. The City of Cape Town, Drakenstein and George municipalities have a fairly wide range of multiple deprivation, and the City of Cape Town, George, Knysna and Mossel Bay municipalities have a fairly wide range in the middle 50% of wards. The middle 50% of wards in Cape Agulhas, Saldanha Bay, Stellenbosch and Swartland are concentrated towards the least deprived end of the distribution.

Figure 2 presents the Western Cape PIMD 2001. The largest concentrations of more deprived wards are within the City of Cape Town municipality (see map inset, where the townships on the Cape Flats can be clearly seen). It should be noted that the wards in the Little Karoo to the north east, though highly deprived and large in geographical area, have relatively small populations. The City of Cape Town municipality also has many of the least deprived wards, with other pockets around Stellenbosch and Malmesbury.

Figure 2: Western Cape PIMD 2001 at ward level (provincial deciles)



5.2 Eastern Cape

Again in the Eastern Cape, the most highly deprived wards score as deprived on several of the domains. The following pattern can be seen for wards that are ranked overall in the most deprived 25% of the Eastern Cape PIMD:

- 100% are in the most deprived 25% on two or more domains;
- 91% are in the most deprived 25% on three or more domains;
- 62% are in the most deprived 25% on four or more domains;
- 27% are in the most deprived 25% on all five domains.

There are 41 wards in the most deprived 25% on all five domains. Of these, ten are in Qaukeni municipality, ten in Mbizana, five in Port St Johns, four in Ntabankulu and the remaining twelve spread across six other municipalities. Table 2 presents the most deprived 20 (of 604) wards in the Eastern Cape; Qaukeni municipality features prominently, having the six most deprived wards. At a higher level of aggregation, district council or metro[18], the concentration of the most deprived wards in one or two areas is noticeable.

[18] Metropolitan areas (of which there are six in South Africa) and district councils (of which there are 47) are at a level below provinces in the geographical hierarchy. The district councils sub-divide into local municipalities or district management areas.

Table 3 presents the distribution of the most deprived 25% of wards by district municipality. Almost 50% of these wards are in the O.R.Tambo district council, with 17% and 15% in the Chris Hani and Alfred Nzo district councils. Interestingly, these are three of the four areas in the Eastern Cape designated (prior to publication of the PIMD) as urban and rural development nodes for the Urban Renewal and Integrated Sustainable Rural Development (ISRD) programmes. This indicates that the most deprived areas in South Africa are being identified in a consistent way, and demonstrates how the PIMD could be usefully employed in future for spatial targeting, a point which is further discussed in section 6.

Table 2: Most deprived wards in the Eastern Cape

	Ward code	Municipality name	Population in 2001 to nearest 1000	PIMD score
1	21503002	Qaukeni	5 000	459.48
2	21503001	Qaukeni	6 000	442.52
3	21503017	Qaukeni	14 000	439.45
4	21503021	Qaukeni	15 000	431.04
5	21503022	Qaukeni	7 000	430.68
6	21503003	Qaukeni	10 000	429.59
7	21504001	Port St Johns	10 000	429.30
8	21502007	Ntabankulu	15 000	423.60
9	21502001	Ntabankulu	10 000	415.75
10	21504012	Port St Johns	15 000	415.67
11	21502003	Ntabankulu	12 000	413.99
12	21501001	Mbizana	1 000	412.93
13	21501019	Mbizana	16 000	411.81
14	21201023	Mbhashe	12 000	403.85
15	21503023	Qaukeni	12 000	403.31
16	21506016	Mhlontlo	9 000	400.84
17	21506008	Mhlontlo	8 000	400.56
18	21501006	Mbizana	13 000	398.42
19	21501007	Mbizana	16 000	396.32
20	21504008	Port St Johns	13 000	394.95

Table 3: Distribution of most deprived 25% of Eastern Cape wards by district municipality

District municipality	Number of wards in most deprived 25%	% of wards in 25% most deprived
DC10: Cacadu	0	0.0
DC12: Amatole	18	11.9
DC13: Chris Hani	25	16.6
DC14: Ukhahlamba	10	6.6
DC15: O.R.Tambo	75	49.7
DC44: Alfred Nzo	23	15.2
NMA: Nelson Mandela Bay Metro	0	0.0
Total	**151**	**100.0**

Note: At the time of the 2001 Census, Alfred Nzo district municipality included Umzimkhulu local municipality. However, following a recent process of municipal demarcation, the municipality has been reassigned to Sisonke district municipality in KwaZulu-Natal province. For the purposes of reporting, and following the lead of spatial initiatives such as the ISRD programme, we have treated Umzimkhulu as part of Alfred Nzo district municipality. Of the 23 most deprived wards falling into the of Alfred Nzo district municipality, 10 are wards in Umzimkhulu.

In Figure 2 the middle 50% of wards in Mbizana, Ntabankulu, Port St Johns and Qaukeni municipalities are concentrated in a narrow range and towards the most deprived end of the distribution. King Sabata Dalindyebo and Mnquma municipalities have a fairly wide range of multiple deprivation among their wards, while Blue Crane Route, Camdeboo and Kouga municipalities have a small range. The middle 50% of wards in Buffalo City, Camdeboo, Kouga, Makana and Nelson Mandela are concentrated towards the least deprived end of the distribution.

Figure 3: Eastern Cape PIMD 2001 – the interquartile range

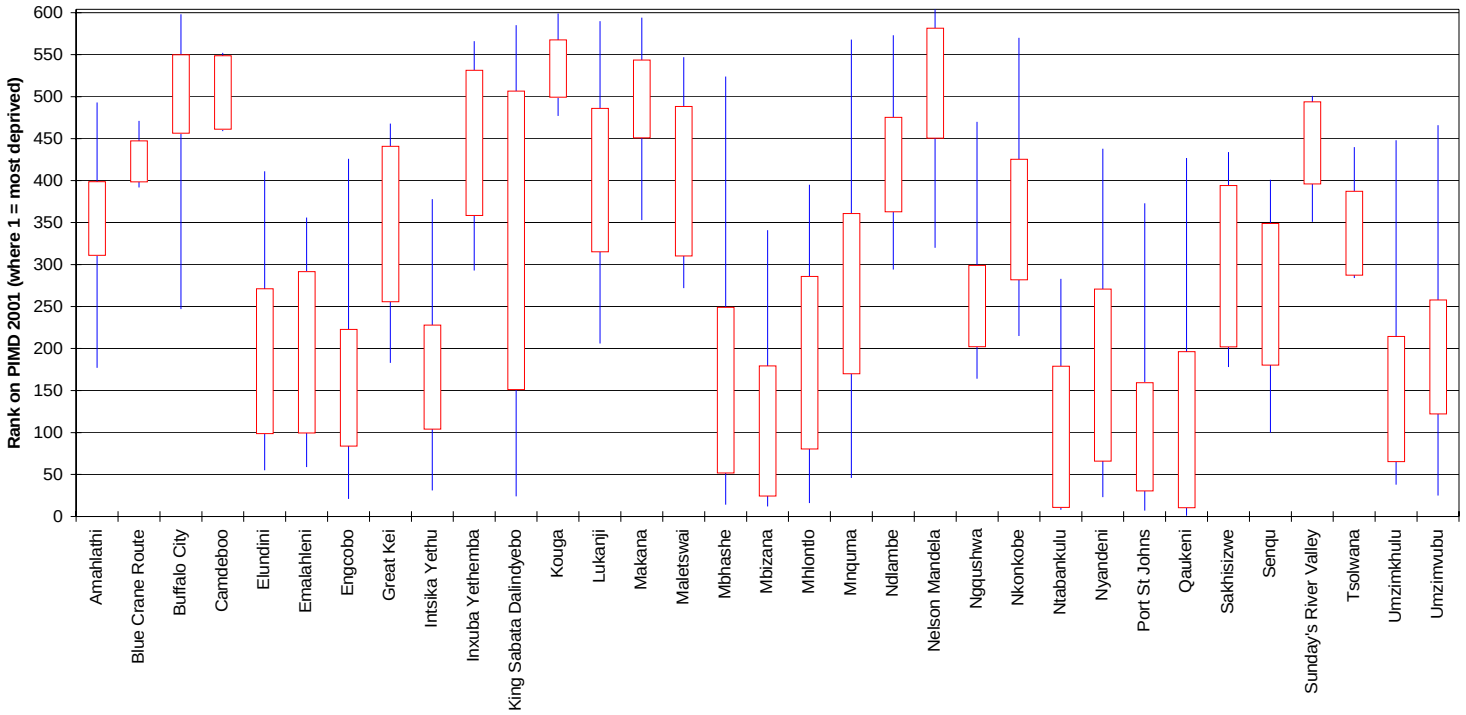
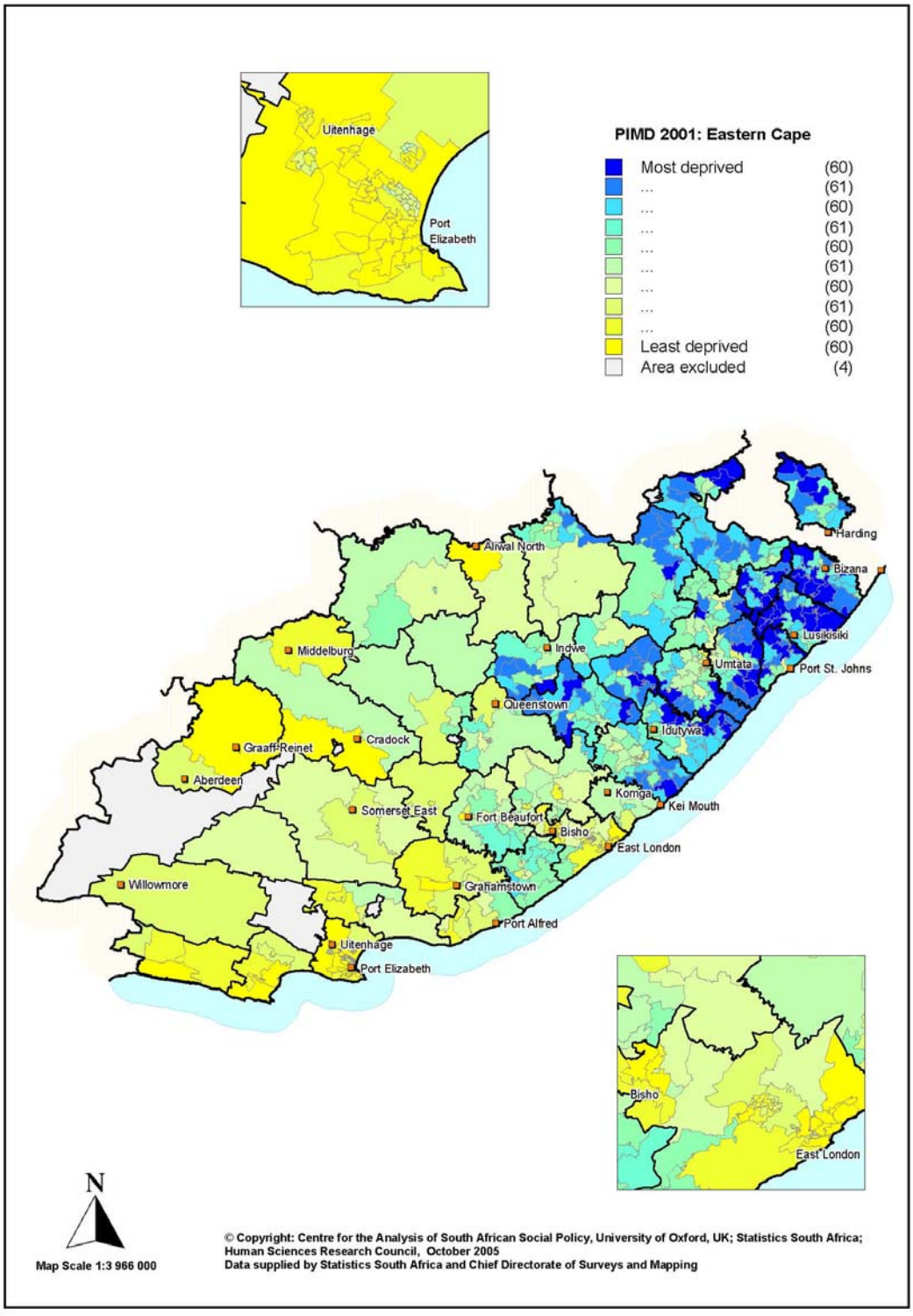


Figure 4 presents the Eastern Cape PIMD 2001. The deprived wards of the Eastern Cape are mainly concentrated within the former Transkei homeland area in the municipalities of Mbizana, Qaukeni, Ntabankulu and Port St Johns. The areas to the west of the province, and particularly wards around Port Elizabeth and East London are relatively less deprived.

Figure 4: Eastern Cape PIMD 2001 at ward level (provincial deciles)



6. Reported and prospective applications

The five domain scores are key outputs and can be used as tools for specific programmes. However many programmes target deprivation in a more general sense, and for these, the multiple deprivation score can be used. Possible uses include:

- Allocating resources and informing detailed service planning by national, provincial and local governments (thereby increasing transparency and accountability, and reducing the use of anecdotal evidence that is not evidence-based).
- Policy related and academic researchers (e.g. a sampling frame for in-depth studies or pilot studies; a tool for contextualising other empirical research).
- Targeting resources provided by donor agencies, companies, voluntary bodies and charities.

Since the PIMD 2001 was placed in the public domain, it has been used by various South African organisations for spatial targeting. These include the African Peer Review Mechanism, the Department of Education in relation to its free education policy, the Department of Water Affairs and Forestry as an input for its planning, and the Department of Social Development as a tool for informing the Expanded Public Works Programme by examining existing rollout of the programme and identifying other neglected areas, and for targeting areas to improve take up of social grants. The indices have also been used as a planning tool at the municipal level.

7. From a provincial to a national index of multiple deprivation

Ideally, the geographical units used in a deprivation measure should be of more or less equal size in terms of population and should be relatively homogenous in terms of deprivation. As discussed above, one of the inherent challenges faced in the development of the South African indices of multiple deprivation is the varying size of wards in the country. This results in provinces with large wards being under-represented in national indices of deprivation and pockets of deprivation in larger wards being hidden by relative non deprivation in the same ward.

Recent efforts to address these issues have led to the construction of new small area units - datazones - by the Centre for the Analysis of South African Social Policy, taking into account homogeneity and population size and using enumeration areas as building blocks. This exercise drew on work that has been carried out to create new small area geographies in the UK[19]. These datazones are simply *analytical* or *statistical* boundaries generated solely to ensure equity and consistency in the geographical measurement of deprivation. They have been created by aggregating existing enumeration areas using a combination of rules and criteria relating to area type, population size and population density. The 23 205 datazones are contiguous and nest within metros or local municipalities; they are relatively homogenous (achieved using cluster analysis); they are as circular as possible (achieved using an index of circularity in the creation algorithm); and the mean population size is 1 931 (the objectives were a minimum of 1 000, a maximum of 3 000 and a target of 2 000).

[19] For more information please visit the following websites:
England and Wales - http://www.statistics.gov.uk/geography/soa.asp
Northern Ireland - http://www.nisra.gov.uk/aboutus/default.asp90.htm
Scotland - http://www.scotland.gov.uk/Publications/2004/02/18917/33243

Figure 5 shows the distribution of informal dwellings (from the 2001 Census) for the City of Johannesburg metropolitan municipality, first at ward level and then at datazone level[20]. These maps show that the datazone level is able to identify pockets of deprivation which are otherwise obscured at ward level. This is particularly apparent to the south of the municipality where the ward level shows uniformly high levels of deprivation, yet the datazone level reveals a wide range of deprivation, including some areas in the least deprived decile nationally (in terms of the type of dwelling). In coming months, the index of multiple deprivation will be rerun using the new statistical geography, thereby creating the first South African Index of Multiple Deprivation (SAIMD) at small area level and opening a range of additional possibilities for use.

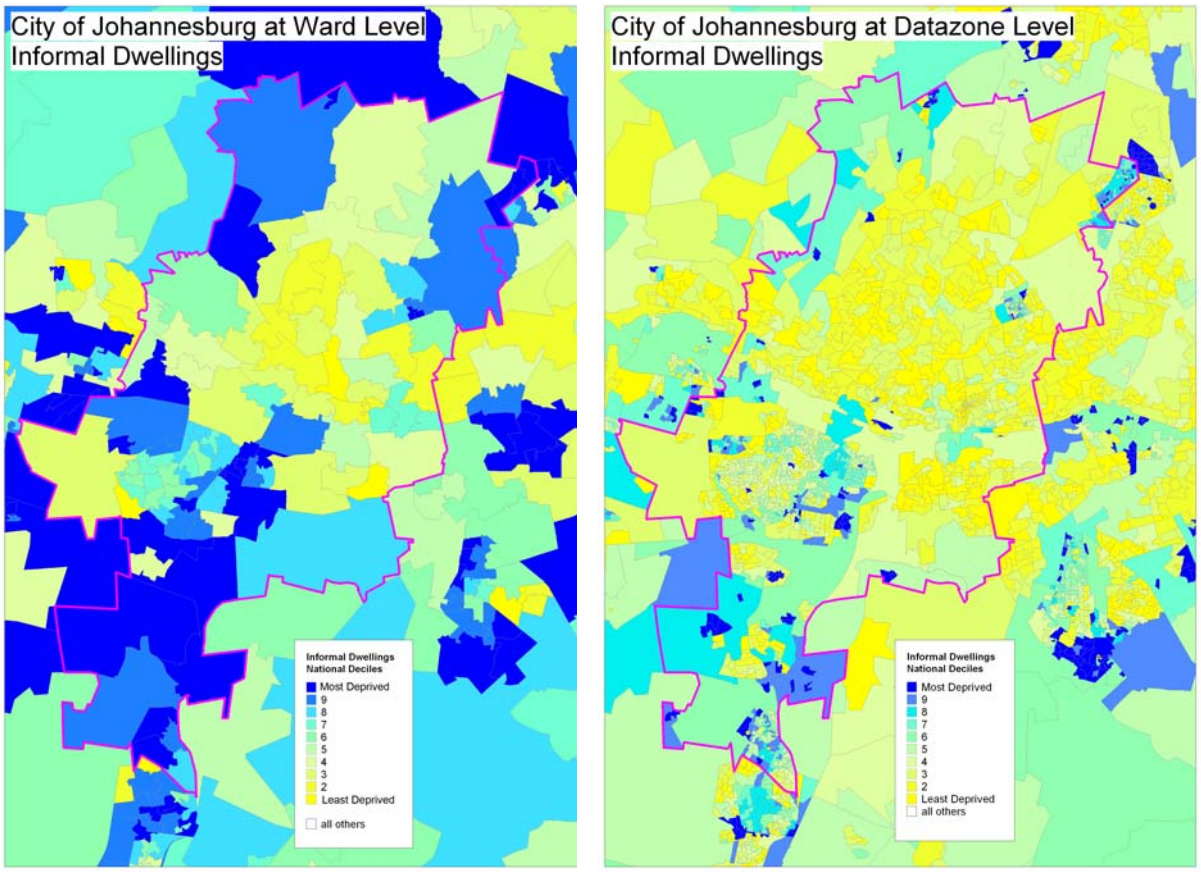
The model of deprivation is designed to be updated to allow for the re-evaluation of the number and nature of the dimensions of deprivation and to allow for new and more direct measures of those dimensions to be incorporated. Alongside the geography developments, a further extension of the SAIMD work is therefore to explore alternative sources of data. This is particularly important as the 2001 Census is now quite out of date and inevitably change will have occurred since that point, but also because some types of deprivation (e.g. prevalence of crime or morbidity) could not be incorporated as there is no information in the Census.

Administrative data sources are used for this type of work in the UK, with only one or two indicators constructed from the Census. There are a number of advantages to using administrative data: it is already being collected and therefore there are no additional costs of collection[21]; it is regularly updated; it can relate to a recent time period, or if historical extracts are retained, it can also provide information about the past; it contains 100% of the records in question; and it is likely to be collected in a consistent way (if a national system) and subject to rigorous quality checks. However, the downside is that the information collected is restricted to what is required for administrative purposes, which may change over time.

A recent review of microdata in South Africa (Barnes et al., 2007a) highlights a number of potential administrative data sources that could be used in future updates, for example, individual records of social assistance beneficiaries (the SOCPEN system). However, the quality and coverage of the data collected varies greatly. Access to data is also restricted in some instances, sometimes because of concerns to safeguard the confidentiality of information on people and organisations. It is hoped that a project such as this could demonstrate the potential of administrative data in a research environment, and at the same time encourage improvements in the quality of the data collected.

[20] These are a draft set of datazones, used only to illustrate the point.
[21] There will be costs associated with data extraction and cleaning though. However, these are likely to be less than the cost of data collected in other ways, for example surveys.

Figure 5: Distribution of informal dwellings in the City of Johannesburg metropolitan municipality at ward and datazone level



8. Extending the approach regionally across the Southern African Development Community (SADC)

The development of the indices of multiple deprivation for South Africa, and the current processes of refinement, represent an important milestone for the Southern African region as a whole, especially in relation to pushing the frontiers of poverty analysis. In April 2008 the SADC International Consultative Conference on Poverty and Development took place in Mauritius, with the overarching purpose of being 'a strategic dialogue that recognises the necessity of regional multi-dimensional strategies and approaches to tackling poverty' (SADC Secretariat, 2008). One of the notable aspects of the conference was the substantive commitment that was made to the development of a regional poverty observatory.

Yet, in spite of this commitment, charting emerging patterns in relation to poverty and inequality in Southern Africa continues to be a significant analytical challenge, owing specifically to issues of data availability, but more broadly to the capacity constraints that face national statistical agencies in regularly monitoring social phenomena such as poverty. At the same time it is important to recognise that, from a historical perspective, never has there been such a wealth of data with which to craft evidence-based policies. Not only is there an increasing commitment to international data collection and dissemination standards, with key surveys being periodically and routinely conducted (e.g. household income and expenditure surveys every five years), but there have also been important experimental methods aimed at facilitating

the rapid production of poverty statistics in between the larger, more technically demanding surveys.

One of the key areas where there has been concerted effort at intra-regional statistical harmonisation is in relation to census data. The SADC Millennium Census Data Analysis Project, which officially ended in December 2005, aimed to harmonise all 2000-round census-taking activities and to develop more comparable indicators of demographic characteristics across the SADC region. At the same time, countries remained free to add their own country specific topics to the regional 'core' set (Noble et al., 2007a). Evidence indicates that most SADC countries attempted to comply with this goal of harmonization in their 2000-round censuses but that a significant amount of difference between national censuses remains. Efforts nonetheless continue to enhance the continent's censuses as a source of valuable data. The implication of this initiative has been that the potential exists for extending the index of multiple deprivation work undertaken in South Africa to form the basis for a SADC Index of Multiple Deprivation (IMD).

9. Concluding remarks

This paper has provided an account of the key principles that were taken into consideration when constructing the recent Provincial Indices of Multiple Deprivation 2001. The various methodological steps involved in constructing the index were described and ward level results from the PIMD for two provinces in South Africa were also presented. They PIMD 2001 provide a tool for people to identify the most deprived areas within each province, a *starting point* from which to consider small area level deprivation, which can be used alongside local up-to-date information. Further developments have already been identified for the work, including a consistent geography (in terms of population size and deprivation levels) and using administrative data. The PIMD 2001 demonstrates that it is possible to measure multiple deprivation at the small area level in developing countries. Similar work could be carried out in other countries in the SADC region, and as highlighted above, would contribute to an emerging evidence-base for monitoring poverty across the region.

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