The Social Sciences 7 (1): 145-158, 2012
ISSN: 1818-5800

Modeling and Visualising the Geodemography of Poverty and Wealth across Nigerian Local Government Areas

[1]Adegbola Ojo and [2]Patrick Oseloka Ezepue
[1]Department of Geography, University of Sheffield, Sheffield S10 2TN, United Kingdom
[2]Department of Computing, Sheffield Hallam University, Sheffield S1 1WB, United Kingdom

Abstract: Numerous researchers, commentators and policy makers have described poverty and inequality as the greatest challenges facing the Nigerian populace. Successive governments have pursued different policy initiatives with a view to mitigating the problem. In spite of large scale investment committed to poverty alleviation programmes, >50% of Nigerians still live in relative poverty with over a third of the population languishing in extreme poverty. To date, there is no published work examining the scale of inequality in poverty and prosperity amongst Nigerians at local spatial scales. In this study, we demonstrate the first attempt to exemplify the potential of geodemographics and spatial analysis in exposing poverty and wealth differences within and between Nigerian Local Government Areas (LGAs). We use a recently developed Nigerian LGA geodemograpic system to analyse data for five poverty quintiles. We discover that different local community types would be better suited to different initiatives as the magnitudes and direction of their predisposition for poverty and wealth vary. The findings reinforce the view that there is value in using geodemographic modeling techniques to better target local populations and to support poverty alleviation programmes in developing countries.

Key words: Poverty, MDGs, geodemographics, local government areas, local community, Nigeria

INTRODUCTION

With a population of >150 million people, Nigeria is the most populous country in Africa. On average, population grew at a rate just >3% in the 1st 8 years of the present millennium (NPC, 2010). Comprising an area totaling 356,669 miles^2, Nigeria has a rich base of human capital and natural resources. The country also ranks among the top ten oil exporters globally. Nigeria maintains a high profile economic and political status on the African continent. Indeed some commentators (Gordon, 2003) agree that several African countries have their economic stability linked to the political and economic steadiness of Nigeria.

In spite of its huge potential, the country is classified as a low-income country (The World Bank groups countries for operational, analytical and other purposes. Based on the bank's income classification of member countries, Nigeria is a low-income country. For more details on the World Bank income classification: http://data.worldbank.org/about/country-classifications). Between 1990 and 2005, an estimated 71% of the population lived on <1 United States Dollar a day (World Bank, 2007). The proportion of Nigerians living in relative poverty currently stands at 54% (NPC, 2010) and needs to fall to about 21% if the country expects to meet one of the targets of the United Nations (UN) Millennium Development Goal (MDG) (The Millennium Development Goals (MDGs) are eight international development goals that all 192 United Nations member states and at least 23 international organizations have agreed to achieve by the year, 2015) aimed at eradicating extreme poverty and hunger. The Nigerian government believes, there is an average possibility of achieving this feat even though, there is weak institutional support for programmes, projects and policies that may ultimately lead the country towards the goal (NPC, 2010).

Researchers have argued that there is value in tackling developmental challenges from the roots and that it requires intelligent analytics in understanding and drilling down to local levels of governance (Ojo and Ezepue, 2011; Ojo *et al*., 2010). The position now appears to be resonating within the corridors of central government.

From the most recent Nigerian MDG report, we extract the following testimonial on the significance of undertaking local level analytics: local governments are closer to the grassroots in providing basic services, so their actions or inactions impact directly upon the MDGs (NPC, 2010).

Corresponding Author: Adegbola Ojo, Department of Geography, University of Sheffield, Sheffield S10 2TN, United Kingdom

In spite of the importance of pursuing a local agenda when evaluating progress towards national development targets within the MDG framework or other important national policy programmes, we discovered that it is hard to come across evidence of such previous research. Tracing the welfare of the Nigerian economy back to the 1970's reveals that the country was expected to function and take its place as one of the major economic giants globally. Nigeria thrived significantly on agriculture and about 60% of Nigerians still work within the agricultural sector (NPC, 2010).

The vibrancy of Nigeria's agricultural sector pre-1980 contributed significantly to industrial development and what was described by Ali-Akpajiak and Pyke (2003) as a growing pool of infrastructure.

The decades following this period saw the country witness numerous military coups and the expansion of the petroleum industry. Alongside some other problems, a long period of political instability and unsustainable oil exploitation has contributed to the blurring of the bright future of the Nigerian economy with many of its citizens surviving beneath poverty lines.

The problem of poverty has been described as a major challenge confronting the Nigerian populace (Ogunbodede, 2006). In the midst of vast amounts of natural resources and human capital (Canagarajah and Thomas, 2001), Nigeria which was categorised as one of the top 50 wealthiest economies in the 1970's has today become one of the 25 poorest countries (Akanbi and Du Toit, 2011).

According to the National Bureau of Statistics (NBS, 2005), it was estimated that in 1980 about 65 million Nigerians lived in relative poverty resulting in a poverty incidence of 28%. This figure rose to 75 million people and a depth of 46% in 1985. Although, the incidence of poverty had reduced marginally to 43% by 1992, there was a sharp rise to 65.6% by 1996. At this time, it was estimated that about 102 million Nigerians were living in relative poverty. Approximately 10 years later, more than half of the country's population (54%) still live in relative poverty while an estimated 35% lived in extreme poverty as at 2007 (NPC, 2007).

Poverty presents multifaceted challenges and it can be difficult and contentious measuring the phenomenon. Common methods and approaches used within geographical analysis range from use of small area estimation techniques to household level analysis. Apart from the purpose of the poverty measurement indicator and the philosophy of the practitioner, Davis (2003) also identified data availability, analytical capacity and cost as drivers of poverty measurement. One of the indicators employed within the MDG framework for monitoring relative poverty levels is the share of poorest quintile in national consumption. For the purpose of the research presented in this study, researchers analysed data for five poverty quintiles sourced from the National Bureau of Statistics, Abuja, Nigeria.

We adopt a geodemographic modeling approach by linking the data with Nigeria's first geodemographic classification system (Ojo *et al*., 2010) to help us quantify and understand the varied distribution of poverty and wealth across different community types thereby revealing some of the correlates of relative advantage and/or disadvantage.

In this study, we illustrate the extent to which spatial analysis and geodemographic modeling may be of benefit for exploring real issues affecting the citizenry at localised spatial scales. Such benefit can complement the efforts of the Nigerian government; the Office of the Senior Special Assistant to the President on MDGs (OSSAP-MDGs); academics and researchers and other local and international stakeholders within the Nigerian development footprint in their endeavours to address a variety of issues associated with welfare inequality amongst Nigerians. For example, there is a current interest on the part of the Nigerian Government to address the problem of mass (graduate) unemployment in the country by setting up a Nigerian Job Creation Committee headed by a prominent industrialist, Alhaji Dangote. It seems appropriate to view unemployment as having both a national character (underpinned by common trends and root causes) and local variations (underpinned by the types of employment opportunities and key sectors providing the opportunities in the different geopolitical zones and their constituent LGAs). The kind of analyses attempted in this study can therefore be used to explore such variations and fine-tune the job creation efforts to existing and emerging local realities.

MATERIALS AND METHODS

Concisely, a geodemographic system is an area classification that simplifies a large and complex body of multivariate and multidimensional information about people where and how they live, work and recreate. Geodemographic systems are developed based on geographical ontologies that similar people with similar characteristics are more likely to live within the same locality and that such locality types will be distributed in different locations across geographical space (Harris *et al*., 2005; Sleight, 1997; Brown, 1991).

In this study, we use the Nigerian Local Government Area (LGA) Geodemographic Classification system and profiler (NIGECS) which is a product of academic research

Table 1: Hierarchical structure of the Nigerian geodemographic typologies

Super-groups labels	Groups	Group labels	Sub-groups
Green towns	1.1	Conventional green towns	1.1.1, 1.1.2, 1.1.3
	1.2	Underprivileged green towns	1.2.1, 1.2.2
	1.3	Flourishing green towns	1.3.1, 1.3.2, 1.3.3
	1.4	Struggling green towns	1.4.1, 1.4.2, 1.4.3
Emerging localities	2.1	Moderately emerging localities	2.1.1, 2.1.2, 2.1.3
	2.2	Comfortable emerging localities	2.2.1, 2.2.2, 2.2.3
	2.3	Transient emerging localities	2.3.1, 2.3.2, 2.3.3
Intermediate territories	3.1	Constrained intermediate territories	3.1.1, 3.1.2
	3.2	Well-to-do intermediate territories	3.2.1, 3.2.2, 3.2.3
	3.3	Deprived intermediate territories	3.3.1, 3.3.2
	3.4	Customary intermediate territories	3.4.1, 3.4.2
Diluted societies	4.1	Thriving diluted societies	4.1.1, 4.1.2
	4.2	Labouring diluted societies	4.2.1, 4.2.2, 4.2.3
	4.3	Deprived diluted societies	4.3.1, 4.3.2
	4.4	Modest diluted societies	4.4.1, 4.4.2, 4.4.3
Country dwellings	5.1	Toiling country dwellings	5.1.1, 5.1.2
	5.2	Deprived country dwellings	5.2.1, 5.2.2
	5.3	Middle-class country dwellings	5.3.1, 5.3.2, 5.3.3
Urban nodes	6.1	Prosperous urban nodes	6.1.1, 6.1.2
	6.2	Disadvantaged urban nodes	6.2.1, 6.2.2
	6.3	Average urban nodes	6.3.1, 6.3.2
	6.4	Affluent urban nodes	6.4.1, 6.4.2, 6.4.3
	6.5	Striving urban nodes	6.5.1, 6.5.2

conducted at the University of Sheffield, United Kingdom (Ojo *et al*., 2010). The Nigerian system encapsulates spatially referenced datasets for the year, 2006 derived from the census and other national surveys sourced from the National Bureau of Statistics. The ten broad themes that the data cover include agriculture, demographics, education, employment, health, household composition, household infrastructure, housing, socio-economic and women and children. All the 774 LGAs in Nigeria have been placed into one of 6 super-groups and into one of 23 groups and finally into one of 57 sub-groups.

This hierarchical structure of super-groups, groups and sub-groups allows for greater flexibility and means that analysis, visualisation and reporting can be done at three levels.

The focus of this study is not to explain the methodological issues considered in the development of the Nigerian system neither is it to provide comprehensive description of the different cluster groups. Additional comprehensive profiles and descriptions of all the cluster groups can be retrieved at www.nigerianlgaclassification.com.

Table 1 shows the structure of the Nigerian system and provide brief descriptions of the 6 super-groups. Green towns concentrate mostly in the South-Western corner of Nigeria but can also be found in the North-central, South-South, South-East and North-East zones of the country. They have an average population density of 450 people km^{-2} and tend to be comprised of residents in older age categories with many pensioners. Secondary education completion rates are generally high with comparatively higher levels of adult literacy.

Emerging localities are largely concentrated in the North-West and pockets of the North-East and North-central zones. While population density is below the national average, the mean household size of these areas is quite high at about 6 people per household. There is a disproportionate concentration of young population within emerging localities, few of whom have completed secondary education.

Intermediate territories can be found mainly within the South-East. They are also scattered across the South-South and some areas of the North-central zone. With a mean household size of 5 people, they have an above average mean population density of 709 people km^{-2}. Intermediate territories are characterised by middle aged and older adults. Many have completed their secondary education.

Diluted societies concentrate in the North-central area of Nigeria. They can also be found in every other geopolitical zone of the country and have a mean household size of 5 people. Their average population density is 643 persons km^{-2}. Diluted societies have much younger population. A good number of people are employed in agriculture. Many use agricultural supplements and a slightly above average number own live stock in commercial quantities. Country dwellings spread across the North-East and North-Western parts of Nigeria. They can also be found in the North-central zone.

The super-group has a mean household size of 5 people and an average population density of 144 persons km^{-2}. These areas have the largest concentration of households owning livestock and make use of agricultural supplements in reasonably large quantities. Middle-aged persons are disproportionately high but literacy levels are generally very low. Many household heads are not educated. Urban nodes have a mean household size of 4.6 people and a very high population density of 5,117 persons km^{-2}. Urban nodes are scattered across the country and do not necessarily concentrate in any geopolitical zone. However, the North-East has the lowest share of LGAs classified as urban nodes. These areas have large concentrations of middle-aged people many of whom are unmarried. There are also a significant number of pensioner households. Literacy rates are generally high. The ownership of mobile phones and personal computers are also the highest nationally.

We secured data on poverty and wealth for 2006 from the NBS Core Welfare Indicators Questionnaire (CWIQ) survey. The sample design employed for survey is a 2-stage cluster sample design in which Enumeration Areas (EAs) or Primary Sampling Units (PSUs) make up the first stage sample while the Housing Units (HUs) from EAs make up the second stage sample. The sample size varies from state to state depending on the number of LGAs in each state. Ten EAs were selected in each of the 774 LGAs resulting in 7,740 EAs. The categorisations of households by poverty quintiles were used as measures of poverty and wealth. The methods used in calculating the poverty quintiles have been described elsewhere (Montgomery *et al*., 2000; Vyas and Kumaranayake, 2006). Essentially, indices of economic status for each household in the survey were constructed using principal components analysis based on household variables like ownership of bicycle, fridge, television, motorcycle and car. Based on the computed indicator each household is assigned to one of five poverty quintiles where poverty quintile 1 represents the poorest and poverty quintile 5 represents the richest households.

The geographical reference of households (LGAs) was included in the dataset. This reference was used to link the datasets from the CWIQ to the Nigerian geodemographic segmentation system for further analysis. Throughout this study, we refer to index values derived by different geodemographic typologies for the poverty quintiles. Indices were computed such that an index score of 100 indicates a level of occurrence of that variable such as poverty quintile 1, equal to the national mean or expected level. An area with an index of 150 would indicate a level 50% above the national average and a score of 200 twice the expected rate (Harris *et al*., 2005).

$$I=\left[[n/\sum_{1}^{k}n]\div[n/\sum_{1}^{k}N]\right]\times 100 \quad (1)$$

Where:

I = The index
n = The count of households with a characteristic, say quintile 1 in geodemographic cluster k
k = The total number of geodemographic clusters
N = The count of households in geodemographic cluster k

The indices were used to describe the propensity for a household within an LGA to belong to any of the five poverty quintiles relative to the national average distribution. This geodemographic approach is anchored on the proposition that areas that are socially or economically disadvantaged differ in terms of their pathology of disadvantage. We believe that in qualitative terms, different types of disadvantaged or even advantaged areas exist, leading also to variations in the levels of advantage or disadvantage. Reflecting on this proposition, we consider that various forms of social and economic disadvantage derive from different chronological trajectories. We also believe that area types are often well matched to quite different priority area programmes. In numerous developed countries, small area deprivation indices are widely used and remain of value particularly within the public sector and for academic research. Such indices are calculated from time to time for relatively small geographic areas ranking them from least deprived to most deprived. Different methods exist for constructing such composite indicators (OECD, 2008). In the United Kingdom for instance, the 2007 Index of Multiple Deprivation (IMD) takes into account seven domain specific deprivation indices and fuses them together. Hence, deprivation can be assessed in terms of income; employment; health and disability; education skills and training; barriers to housing services; living environment and crime (CLG, 2008). Nigeria has never had measurable indices of deprivation or welfare for its LGAs. Such indices can be important for discriminating relative levels of deprivation and provide a useful resource for trend analysis if computed over time. In this study, we developed a method to fuse the five poverty quintiles together in order to create a national picture of welfare at the LGA level and to further analyse relative welfare across the geodemographic typologies. The first step in

Table 2: Magnitude of performance for four LGAs

Geopolitical zone	State	LGA	Q1	Q2	Q3	Q4	Q5
South-East	Ebonyi	Afikpo North	-19	34	-23	-2	45
North-East	Gombe	Balanga	9	-21	98	-24	-97
North-West	Jigawa	Gagarawa	84	23	29	90	-1
South-West	Lagos	Ifako-Ijaiye	90	40	-14	74	93

the process of computing the composite indicator was to calculate for each LGA and poverty quintile, the number of households per every 1000 households as follows:

$$T_q = \frac{1000 \times W_q}{N_{LGA}} \quad (2)$$

Where:

T_q = Represents the number of households per 1000 households in the LGA in quintile q

W_q = Represents the households in the LGA belonging to quintile q

N_{LGA} = Represents the total number of households in the LGA

The next step was to examine how each LGA performs (P_q) within each quintile. To achieve this, we compared the statistics for each LGA and quintile with the national statistic for that quintile. Hence, the number of households per 1000 households in each LGA (T_q) was related to the national values. For every LGA, the value of T_q was divided by the national equivalent and multiplied by 100. These figures were used to assess the magnitude of performance in positive or negative terms for each quintile and LGA.

Table 2 shows the performance magnitudes for six LGAs in each of the six geo-political zones of the country. If you consider only Quintile 5 households (Q5), Ifako-Ijaiye LGA in Lagos state outperforms the other five LGAs. However, Gagarawa LGA outperforms it when quintile 4 is considered:

$$P_q = \frac{R_q - R_{q(min)}}{R_{q(max)} - R_{q(min)}} \times 100 \quad (3)$$

Where:

P_q = Represents the standardised performance score of an LGA for quintile q

R_q = Represents the magnitude of performance of an LGA for quintile q

$R_{q\,(min)}$ = Represents the minimum value of R_q across all LGAs for quintile q

$R_{q\,(max)}$ = Represents the maximum value of R_q across all LGAs for quintile q

The SWS for each LGA is the arithmetic mean value of the standardised performance scores (P_q) across each of the five quintiles. We have assigned a score to each LGA in the country. The composite indicator which we call Standardised Welfare Scores (SWS) for each LGA was derived by combining the five performance magnitudes. The negative values for the performance scores were eliminated by standardising the distribution for each between a range of 0 and 100 as shown in Eq. 3.

RESULTS

Geodemographic variations across different poverty quintiles: In proportional terms, poverty quintile 1 represents the top 5th (i.e., top 20%) of core poor group of people in the Nigeria. Table 3 shows the results of preliminary analysis of the data at the super-group level of the Nigerian segmentation system.

This initial exploration provides some background. However, evidence from comparative analysis of geodemographic systems has shown that better discrimination may be achieved when the cluster groups are better-disaggregated (Leventhal, 1995; Ojo, 2009). Figure 1 shows results from analysis by NIGECS groups. The first observation which also conforms to the pattern of findings at the super-group level is that all groups within intermediate territories, diluted societies and country dwellings record values above the national mean. However, there are variations in the magnitudes of the patterns of these indices. The chance of a household being classed as quintile 1 within deprived diluted societies and deprived intermediate territories is almost treble the national mean while that of deprived country dwellings is about double the national average.

The spatial disaggregation of penetration rates indices calculated can be useful for visualisation as shown in Fig. 2. It would seem from the map that the concentration of households with the greatest likelihood to be classed as quintile 1 lie within the South-Eastern corner of the country, spreading through the Eastern end of the North-central to the North-Eastern corner. However, one can also detect from the map, pockets of such LGA types in the South-West and North-West. When analysed with the Nigerian geodemographic system, Green towns have the largest national share (24%) of quintile 2 households. This is again due in part to the large housing density within these areas.

Emerging localities and urban nodes share 34% of households within this poverty quintile and are closely followed by intermediate territories which

Table 3: Penetration report for quintile 1 households by NIGECS super-groups

Super-groups	Household share (%)	Rate (per 100 households)	Index
Green towns	25	22.57	103
Emerging localities	14	17.44	80
Intermediate territories	20	31.59	145
Diluted societies	18	30.65	140
Country dwellings	13	32.30	148
Urban nodes	10	9.520	44

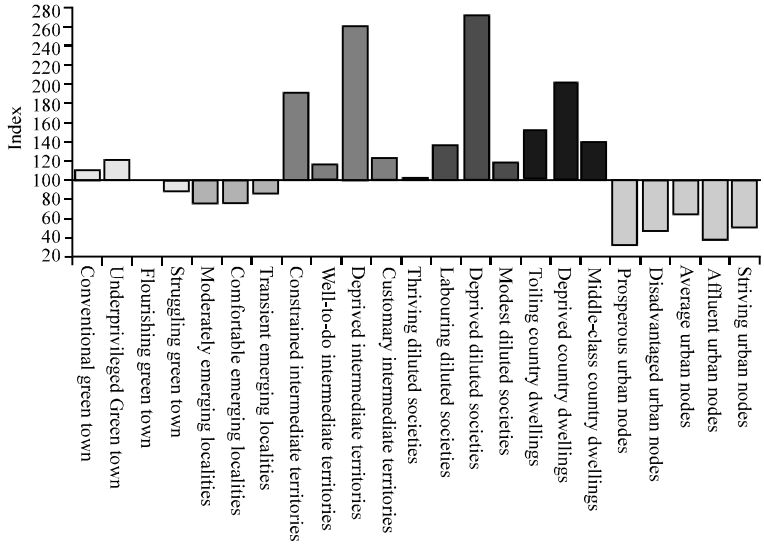

Fig. 1: Indices for quintile 1 households by NIGECS groups

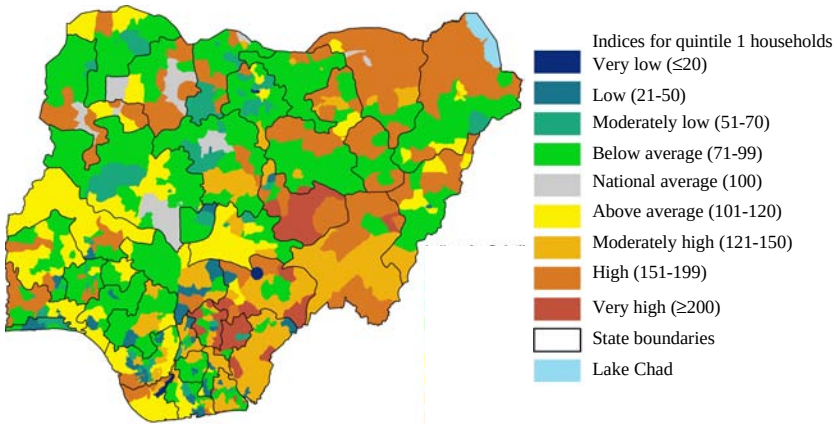

Fig. 2: Geodemographic mapping of quintile 1 households

have 16% of their households defined as quintile 2. Diluted societies and country dwellings have the lowest national shares of 14 and 13%, respectively.

Even though, it is outside the immediate scope of this study to examine the wider implications of different quintiles for an empowered middle class, we can glean the connection between these results and expectations of building a virile middle class vital to private sector wealth creation in the country. For instance, it is worrisome that such a high percentage of urban dwelling Nigerians are quintile-2 poor given that a financially healthy urban middle class is central to provision of good education to next generations of Nigerians and catering to the needs of dependent parents and adults. Of greater significance however is the index of households within the quintile. In spite of their lower national household shares, only

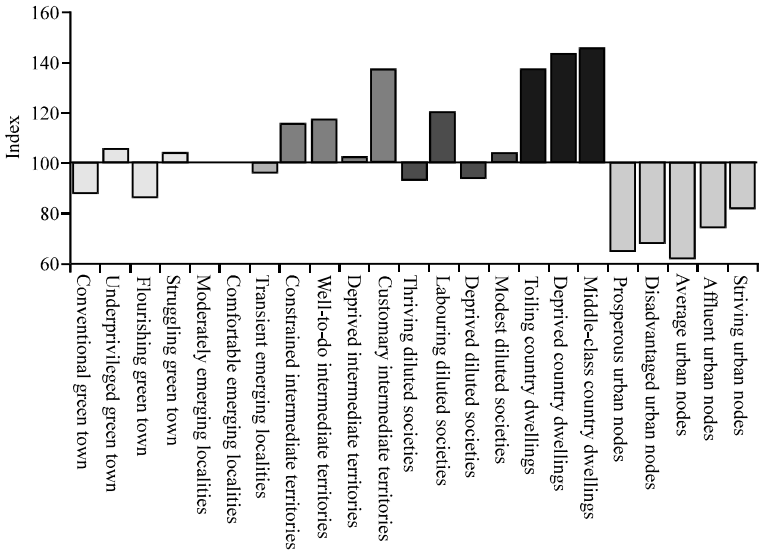

Fig. 3: Indices for quintile 2 households by NIGECS groups

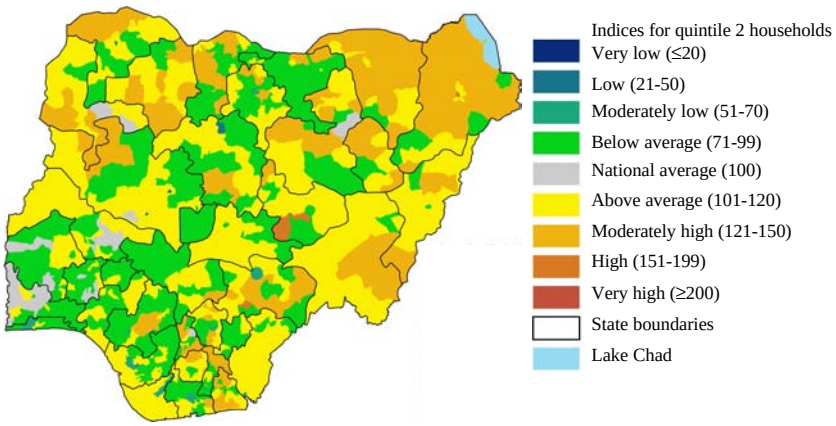

Fig. 4: Geodemographic mapping of quintile 2 households

country dwellings, intermediate territories and diluted societies record rates above the national mean with the highest index of almost one and half times the national average found within country dwellings.

The pattern of variation in the distribution of quintile households is made vivid in Fig. 3. All NIGECS groups within the country dwellings have a strong likelihood to have quintile 2 households. There is also a moderately high chance for households in customary intermediate territories to belong to the poverty quintile.

In Fig. 4, we show the spatial pattern of the likelihood of LGAs to comprise households in poverty quintile 2. From the map, it is obvious that households within the South-Western corner of the country have the least probability of having quintile 2 characteristics.

When we analysed quintile 3 households, the first evidence from the chart shown in Fig. 5 suggests a gradual transition of better welfare to Emerging Localities and Urban nodes from the other four geodemographic typologies.

Figure 6 shows the spatial distribution of the propensity for households to belong to poverty quintile 3. From the map, there appears to be a North-South divide in the distribution. Directly above quintile 3 are the next 20% of households which are deemed to be constituted by residents of a better socio-economic and welfare status.

Table 4 shows the penetration report for households in quintile 4 across NIGECS super-groups. For all households within the quintile, urban nodes and green

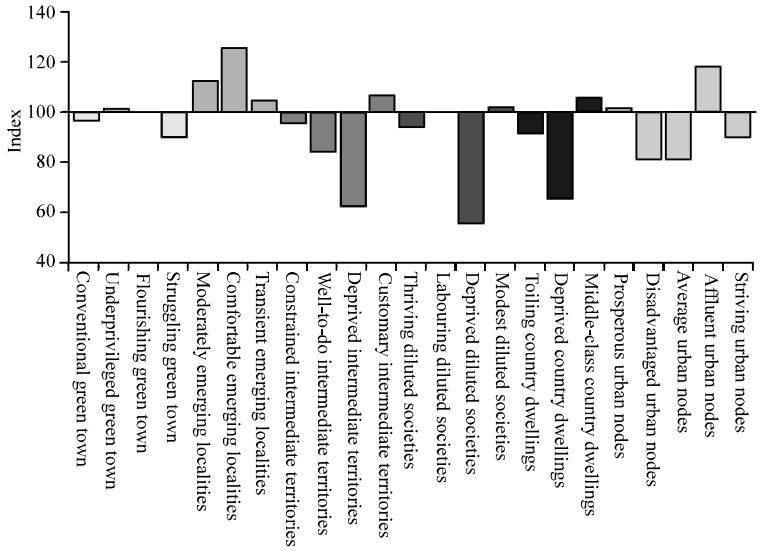

Fig. 5: Indices for quintile 3 households by NIGECS groups

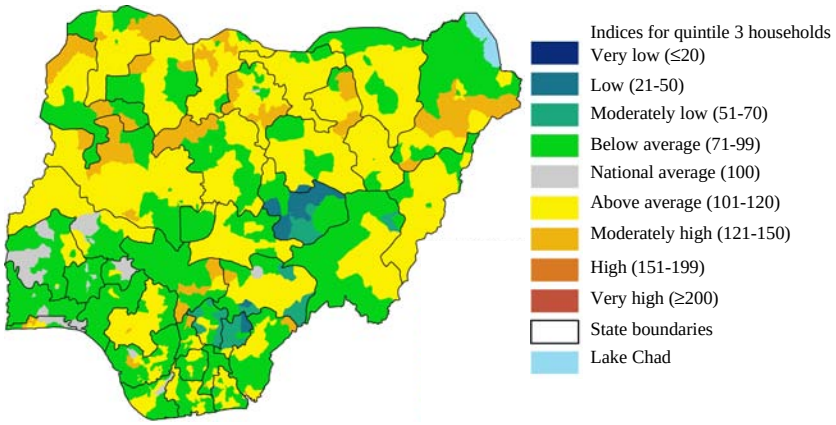

Fig. 6: Geodemographic mapping of quintile 3 households

Table 4: Penetration report for quintile 4 households by NIGECS super-groups

Super-groups clusters	Household share (%)	Rate (per 100 households)	Index
Green towns	23	17.79	93
Emerging localities	21	23.75	124
Intermediate territories	10	14.19	74
Diluted societies	10	14.92	78
Country dwellings	6	12.26	64
Urban nodes	30	24.93	131

towns together account for >50%. However, the urban nodes have the greatest chance of containing a quintile 4 household. They are closely followed by emerging localities which have a likelihood of 24% higher than the national mean. All the other geodemographic typologies have below average representations with the country dwellings having the least index.

As shown in Fig. 7, the system is again able to uncover above average probabilities for quintile 4 households to be found in the urban nodes and emerging localities.

Leading the pack are the Affluent urban nodes and the comfortable emerging localities. Further analysis of the spatial distribution of quintile 4 is shown in Fig. 8. At the top of the welfare and social hierarchy lies quintile 5. The wealthiest households belong to this quintile (Aigbokhan, 2000). In the categorisation used for this analysis, quintile 5 households refer to the top 20% richest households in the country.

Figure 9 shows output from the analysis of quintile 5 households by NIGECS groups. The dominance of the urban nodes is evident though surprisingly, the disadvantaged urban nodes present the greatest index

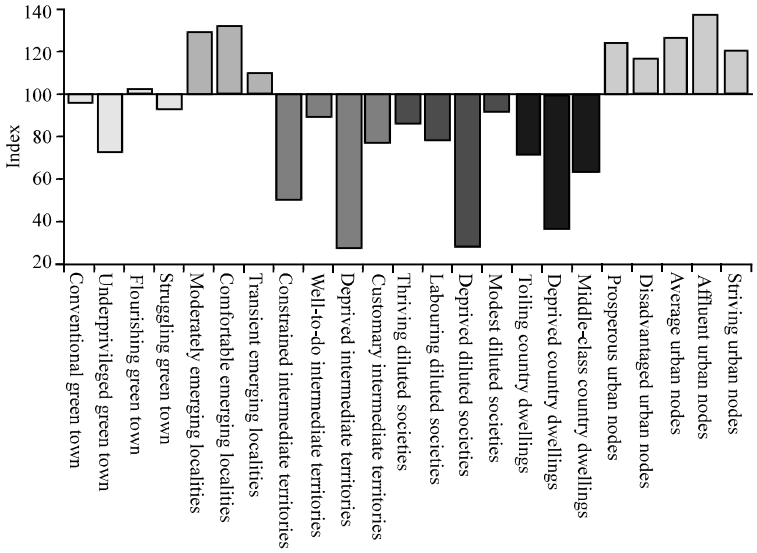

Fig. 7: Indices for quintile 4 households by NIGECS groups

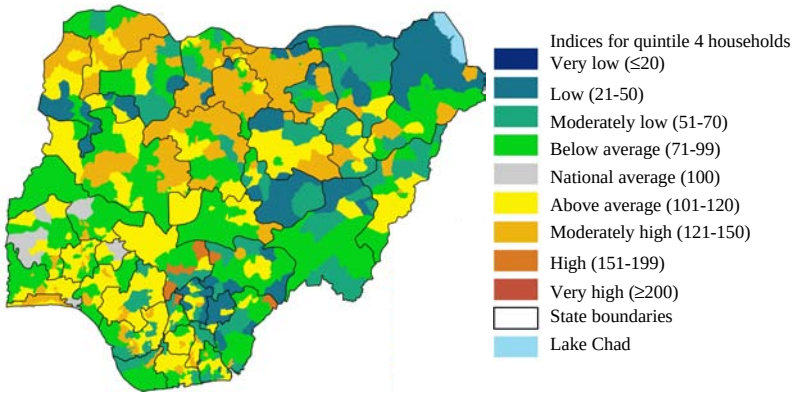

Fig. 8: Geodemographic mapping of quintile 4 households

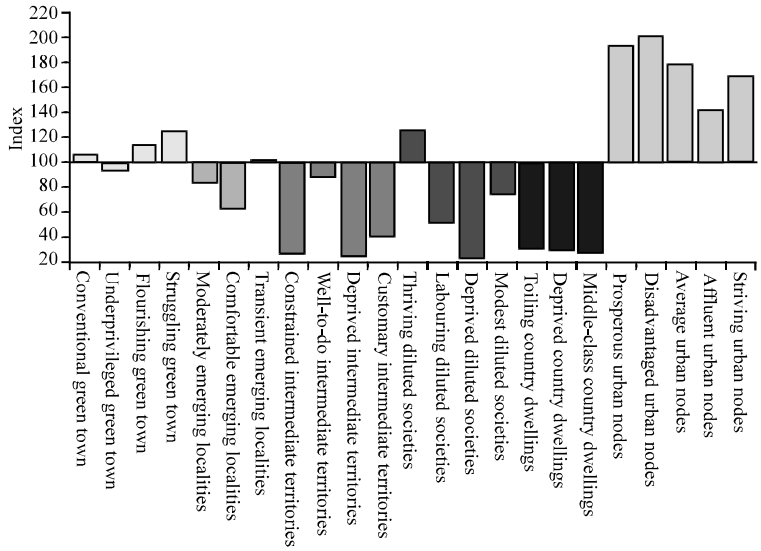

Fig. 9: Indices for quintile 5 households by NIGECS groups

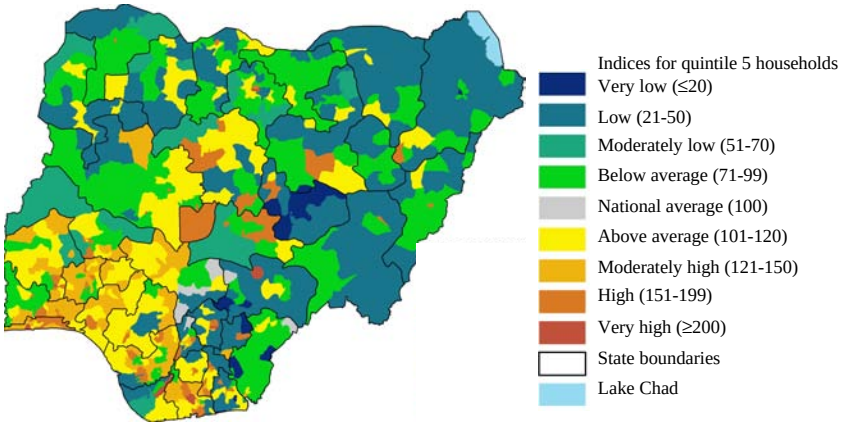

Fig. 10: Geodemographic mapping of quintile 5 households

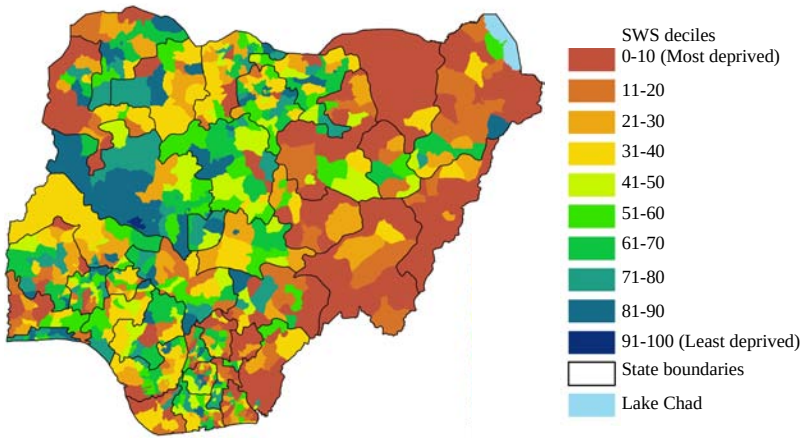

Fig. 11: Percentile ranking of standardised welfare scores

(about double the national mean) for quintile 5 households. The spatial patterning of quintile 5 households extrapolated at LGA scale and shown in Fig. 10 is a sharp contrast to the pattern for quintile 1. Major cities like Abuja and Lagos have strong concentrations of this quintile relative to the national distribution.

Standardised welfare scores and further evidence of welfare inequality: In Fig. 11, we used percentiles to illustrate the relative rank position of each of the 774 LGAs by Standardised welfare scores.

Evidence from the map suggests that relative levels of deprivation are greatest in the Eastern half of Nigeria and appear to concentrate in the North-East. Results from the model conform to findings of earlier work done at regional and state levels (UNICEF, 2009; NBS, 2005).

The local level dimension of the analysis makes it novel and more relevant to neighbourhood level decision making, policy development and deployment. Researchers conducted additional analysis with the SWS by linking the scores for each LGA to their respective NIGECS groups.

To explain the magnitude of inequality existing within each group, we aggregated the SWS for their respective LGAs and calculated within-group standard deviations of the SWS (Crawshaw and Chambers, 2001). A median score was also calculated to provide a summary statistic for relative welfare by NIGECS groups.

In Fig. 12, researchers illustrate results from these analyses graphically. The pattern across the geodemographic clusters shows that overall level of relative deprivation is lowest for the urban nodes. Subsequent to the urban nodes, emerging localities experience better well-being.

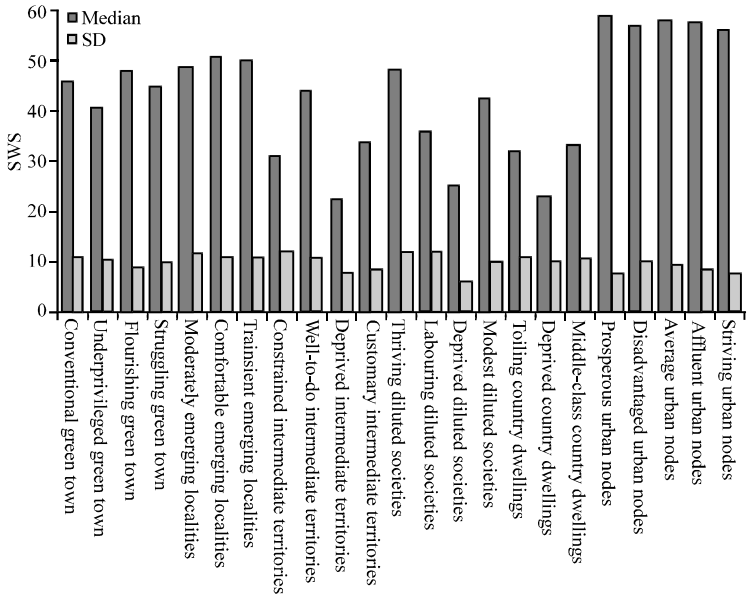

Fig. 12: Comparative distribution of welfare inequality by NIGECS groups

DISCUSSION

Based on evidence contained in Table 3, the pattern of penetration of households within this poverty quintile is closely associated with urban-rural dichotomy. In general, poverty quintile 1 households appear to be over-represented within the countryside. Country dwellings have the highest rates of poverty quintile 1 households in the country. The indices also reflect relatively high likelihood rates of households in this quintile being concentrated in intermediate territories and diluted societies. When combined together, these three geodemographic typologies sum up to 51% of the share of all quintile 1 households. This figure is very close to the 54% of the Nigerian population said to be living in relative poverty.

Evidence from the geodemographic profiling suggest that quintile 1 households tend to concentrate in areas where adult literacy levels are generally low and household heads are not educated. Household sizes are typically large and there is a large concentration of widows, especially in the deprived intermediate territories. Unemployment and underemployment are also critical causation factors within deprived intermediate territories. Although, unemployment rates are just above average within deprived diluted societies and deprived country dwellings most people tend to be self-employed in agriculture without mechanised farming. Even though, people tend to own their homes within these areas most homes lack basic livelihood and sanitation facilities. Another major problem confronting residents is the distance, they have to travel to get to their nearest public facilities. Many have to spend >1 h. Although, the UN MDGs focus only on the indicator for quintile 1, we believe it is also important to study spatial patterns of the other poverty quintiles understanding the types and levels of variation existing within the other poverty quintiles may prove useful for shaping social policies. While quintile 2 households in Nigeria may not necessarily be classed as being in core poverty, they are still poor because their welfare and consumption levels are below internationally accepted standards (NPC, 2007; NBS, 2005).

Some of the key geodemographic correlates of quintile 2 households include relatively high dependency ratios and polygamous marriage; employment within the informal sector; low literacy levels; residents travelling over an hour to their nearest food market and source of public transportation; large scale use of religious hospitals; widowed households; residents sourcing water from unprotected sources like wells or open rivers and high levels of diarrhoea prevalence amongst young children.

Emerging localities, especially the comfortable emerging localities where polygamous marriage is common and households typically comprise >6 people have the greatest representation of quintile 3 households. Self-employment is also a key feature of residents of these areas. The findings also suggest that quintile 3 households are more likely to consist of separated

couples and middle-aged persons. Figure 7 shows the distribution of indices for quintile 3 households by NIGECS groups and for quintile, 4 households. What is perhaps striking is that deprived intermediate territories, deprived diluted societies and deprived country dwellings have a chance of less than half the national mean for a household to belong to this better-off quintile. Again, this provides some understanding of the magnitudes of and direction of the unequal distribution of welfare among the population groups. The spatial patterning of the results from the analysis of quintile 4 does not necessarily reveal any regional concentration but underscores the fact that major cities and urban centres are more likely to contain households within the quintile.

An important factor contributing to the high incidence of disadvantaged urban nodes when quintile 5 is analysed is the disproportionate concentration of the geodemographic typology in abuja, the federal capital territory. About 55% of the population of Abuja falls into this NIGECS group. Although, the incidence of unemployment is highest within these areas, public sector employment is also highest for the disadvantaged urban nodes than for any other group. However, numerous pensioners are not paid regularly.

Those who are economically active have just an average representation. It is also common to find a large representation of private formal entrepreneurs within these areas (another implication of the Abuja effect) and the dominant presence of people in rented accommodation. Some other key geodemographic correlates of residents include high levels of ownership of mobile phones and personal computers and high rates of vehicle ownership much higher than motorcycle ownership.

An appraisal of the two statistics shown in Fig. 12 shows that the three NIGECS groups with the greatest levels of deprivation include deprived intermediate territories, deprived country dwellings and deprived diluted societies. Generally, these community types are characterised by higher dependency ratios as young children often dominate the areas. In the case of deprived intermediate territories, aged people >60 years contribute more to the high level of dependency ratio.

The level of agricultural activities within these areas is also quite high due in part to their rural inclination. However, farmers, fishermen and other agricultural cultivators rarely receive support from the government or donor agencies. Most of them purchase their agricultural supplements from open markets.

Another common feature of these areas is that many people of marriageable age are not married. Although, it should be mentioned that polygamy is quite common in deprived country dwellings. These areas are also generally characterised by low levels of educational attainment. It is quite common to find representative numbers of uneducated household heads. In Nigeria, household heads have strong control over the decisions of members of the household. Sometimes, absence of an educated household head can have a negative impact on the children. There are also significant connections between poverty and education. This also perhaps explains why some of these areas continue to experience comparatively higher levels of deprivation. In general, residents of these relatively deprived areas find it difficult meeting their basic day to day needs particularly the payment for school fees and health care services.

Another major issue contributing to poverty within these communities is the problem of communication and access. In spite of the relative high level of proliferation of mobile phone technologies within Nigeria in recent years, residents of these areas do not fully benefit. Additionally, there is a very large representation of households that spend >1 h to their nearest food market or point of public transportation. Again, all these evidences point to the fact that these areas are highly rural and socially and economically excluded from the rest of society (UNICEF, 2009).

To provide further explanation on the relationship between welfare and spatial inequality, we compared the median SWS with their corresponding standard deviations for each NIGECS group. For LGAs within green towns there is no clear relationship between welfare and the pattern of inequality although, it is evident that the least disadvantaged green town (Flourishing green town) also experiences the lowest level of welfare inequality.

The story for the groups in emerging localities is different. For LGAs defined by these geodemographic typologies, one can deduce that the gap between wealthy and poorer households is great. All the three groups within emerging localities are comparatively advantaged as shown in Fig. 12 but the trend of inequality is not encouraging. This again underscores the importance of treating communities differently when embarking on policy initiatives.

In the case of intermediate territories, there is no clear pattern in the relationship between the two statistics. However, it is apparent that LGAs in the NIGECS group with the most acceptable level of welfare also experience high levels of inequality. However, deprived intermediate territories which are generally disadvantaged, show the least incidence in the gap between rich and poor households. The trend within diluted societies is quite similar to intermediate territories. However, it is pertinent

to note that of all the 23 NIGECS groups, deprived diluted societies are characterised by the greatest level of welfare inequality.

Country dwellings are generally disadvantaged however, the inequality between households is also generally high. Indeed, amongst the three most deprived NIGECS groups, the deprived country dwellings demonstrate the greatest level of variability in well-being. When urban nodes are observed in comparison with country dwellings, a sharp contrast is apparent. While these LGAs (Urban nodes) tend to enjoy comparatively acceptable levels of welfare relative to the other NIGECS groups, the pattern of inequality they demonstrate is also relatively lower unlike the country dwellings. Amongst the urban nodes, the most deprived one (Disadvantaged urban nodes) experiences the greatest variability in relative levels of well-being.

CONCLUSION

Researchers have shown that by linking ancillary datasets like measures of poverty and wealth to the Nigerian geodemographic system, it is possible to discriminate for local level evidence of inequality. Such evidence can be useful for shaping policies because it is further substantiated by spatial and a-spatial indicative factors contributing to these disparities.

We have also shown that local level diversity in prosperity and poverty exists both within and between Nigerian local communities. We have also demonstrated that the development and application of modeling techniques such as those used in this report can be helpful in interpreting geographically referenced datasets and constructing bespoke solutions for the special challenges faced by Nigerians at the LGA scale.

Exploratory spatial data analysis and modeling has been undertaken using the Nigerian LGA geodemographic classification system and profiler in combination with secondary statistics derived from the Nigerian National Bureau of Statistics. We found that the poverty indicators analysed are more or less likely to be correlated with different community types enabling the identification of special population groups.

The broader implications of these analyses and visualisations needs to be appraised with regard to the propagation of information to positively influence change in reducing welfare inequality in Nigeria. We believe these techniques will also provide intelligence to validate and exemplify the aptness of resource allocation. This is of particularly relevance to funding policy programmes tied to specific community programmes aimed at tackling Nigeria's poverty challenge.

This study suggests the need for further research that will provide national and local evidence of disparities; particularly the strengths of association among potential poverty related factors such as virility of the middle-class and related opportunities for wealth creation; informed approach to job creation in different parts of the country; the determination of the most critical factors whose mitigation would reduce poverty more profoundly across the country and optimal design of such interventions.

ACKNOWLEDGEMENTS

This research was supported by the University of Sheffield, United Kingdom [Grant reference number GAB 77772006].

REFERENCES

Aigbokhan, B.E., 2000. Poverty, Growth and Inequality in Nigeria: A Case Study. African Economic Research, New Jersey, USA., ISBN: 9789966944252, Pages: 66.

Akanbi, O.A. and C.B. Du Toit, 2011. Macro-econometric modelling for the Nigerian economy: A growth-poverty gap analysis. Econ. Model., 28: 335-350.

Ali-Akpajiak, S.C.A. and T. Pyke, 2003. Measuring Poverty in Nigeria. Oxfam, UK., ISBN: 9780855985028, Pages: 71.

Brown, P.J., 1991. Exploring Geodemographics. In: Handling Geographical Information, Masser, I. and M.J. Blakemore (Eds.). Longman Scientific and Technical, London, pp: 221-258.

Canagarajah, S. and S. Thomas, 2001. Poverty in a wealthy economy: The case of Nigeria. J. Afr. Econ., 10: 143-173.

CLG, 2008. The English Indices of Deprivation 2007. Communities and Local Government, London.

Crawshaw, J. and J. Chambers, 2001. A concise course in advanced level statistics: With worked examples. 4th Edn., Nelson Thornes, Cheltenham, ISBN: 9780748754755, Pages: 686.

Davis, B., 2003. Choosing a Method for Poverty Mapping. Food and Agricultural Organization Economic and Social Department, Rome.

Gordon, A.A., 2003. Nigeria's Diverse Peoples: A Reference Sourcebook. ABC-CLIO, Santa Barbara, ISBN: 9781576076828, Pages: 291.

Harris, R., P. Sleight and R. Webber, 2005. Geodemographics, GIS and Neighbourhood Targeting. John Wiley and Sons, New York, ISBN: 9780470864135, Pages: 293.

Leventhal, B., 1995. Evaluation of geodemographic classifications. J. Target. Measure. Anal. Market., 4: 173-183.

Montgomery, M.R., M. Gragnolati, K.A. Burke and E. Paredes, 2000. Measuring living standards with proxy variables. Demography, 37: 155-174.

NBS, 2005. Poverty Profile for Nigeria 2005. National Bureau of Statistics, Abuja.

NPC., 2007. Nigeria millennium development goals: 2006 report. National Planning Commission, Abuja.

NPC., 2010. Nigeria 2010 millennium development goals report. Government of the Federal Republic of Nigeria, Abuja.

Ogunbodede, E.F., 2006. Developing geospatial information for poverty reduction: Lessons and challenges from Nigeria's 2006 census. Proceedings of the GSDI-9 Conference, November 6-10, 2006, Santiago, Chile.

Ojo, A., 2009. A proposed quantitative comparative analysis for geodemographic classifications. Yorkshire and Humber Public Health Observatory Technical Report.

Ojo, A.A., D. Vickers and D. Ballas, 2010. The segmentation of local government areas: Creating a new geography of Nigeria. Applied Spatial Anal. Policy, 10.1007/s12061-010-9058-0 .

Ojo, A. and P.O. Ezepue, 2011. How developing countries can derive value from the principles and practice of geodemographics and provide fresh solutions to millennium development challenges. J. Geography Regional Plan., 4: 505-512.

OECD, 2008. Handbook on Constructing Composite Indicators: Methodology and User Guide. Organisation for Economic Co-operation and Development, Paris, ISBN: 9789264043459, Pages: 158.

Sleight, P., 1997. Targeting Customers: How to Use Geodemographic and Lifestyle Data in Your Business. NTC Publication, Oxford.

UNICEF., 2009. The State of the World's Children 2009: Maternal and Newborn Health. United Nations Children's Fund, New York, ISBN: 9789280643183, Pages: 158.

Vyas, S. and L. Kumaranayake, 2006. Constructing socio-economic status indices: How to use principal components analysis. Health Policy Plan., 21: 459-468.

World Bank, 2007. World Development Indicators 2007. The World Bank, Washington DC., ISBN-13: 9780821369593.