

A socio-spatial perspective of multi-dimensional poverty in Delta state, Nigeria

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Abstract This paper examined the socio-spatial factors influencing the severity of multi-dimensional poverty at the household level with a view to untangle the variations over space. Studies of multi-dimensional poverty at the household level rarely focus on multiple deprivations, poverty severity and variation in the distribution of multi-dimensional poverty. Stratified sampling technique was adopted while 2521 households were randomly selected for the survey. Geographical information system (GIS), principal component analysis (PCA) and analysis of variance (ANOVA) were used to examine urban poverty variations experienced. Multi-dimensional poverty was measured based on deprivations in more than 50% of multi-dimensional indicators adopted. The most deprived households were found in delta south senatorial district with a severity index of 1729. The severity index of deprived households varies from 0.1729 in Delta South Senatorial District to 0.1463 in Delta North to 0.1418 in Delta Central along education, health and living standard dimensions. The result of the ANOVA based on further analysis of the extracted components in the PCA is statistically significant at $p \leq 0.001$ with F value of

($F = 527.305$). Identification of different poverty categories and inclusion of the multi-dimensionally poor in poverty reduction policies is vital to the eradication of poverty in Delta state.

Keywords Socio-spatial perspective · Multi-dimensional poverty · Sustainable livelihood framework · Poverty reduction · Nigeria

Introduction

Poverty is a multidimensional, dynamic, complex, gendered and location specific phenomenon (World Bank 2000). Due to its multidimensional nature, different disciplines adopt different approaches. A geographer would approach the subject from the spatial perspective, location–allocation and distribution of infrastructures, access to welfare services and information. Identifying spatial patterns of poverty status provide new insights into the socio-spatial dynamics of poverty, poverty severity. Poverty rates and the dynamics differ considerably in different parts of the country and the number of poor Nigerians living below the poverty line has grown measurably (NBS 2010). Although, poverty is a rural phenomenon but the share of the poor living in urban areas is rising with urbanization, both the quantitative and qualitative measurements attest to the growing incidence and

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depth of poverty in the country (Okunmadewa et al. 2005).

This poverty situation however presents a paradox, considering the vast human and physical resources that the country is endowed with. Alayande and Alayande (2004) states that Nigeria suffers from high levels of poverty in spite of her enormous wealth of human and material resources. The National Bureau of Statistics (2012) report indicates that about 112.52 million Nigerians live below the poverty line. This represents about 68.7% of the Nigerian population. Poverty has been massive, pervasive, and has engulfed a large proportion of the Nigerian society. The scourge of poverty in Nigeria is an incontrovertible fact, which results in hunger, ignorance, malnutrition, disease, unemployment, poor access to credit facilities, low life expectancy as well as a general level of human hopelessness Abiola and Olaopa (2008). Despite government's effort to reduce poverty incidence through poverty alleviation programmes, strategies and the quest to be one of the 20 largest economies by the year 2020, Nigeria continues to be one of the poorest countries in the world.

Previous efforts at analyzing poverty used uni-dimensional measures and did not investigate issues of socio-spatial dynamics of urban poverty, poverty severity at the household level using a single cross-section in a multi-dimensional approach. Researches on multi-dimensional poverty have largely focused on the socio-economic determinants of poverty in Nigeria. For instance (Akerele and Adewuyi 2011; Edoumiekumo et al. 2013; Oyekale and Oyekale 2013; Ifelunini et al. 2013; Alkire and Housseini 2014) provides an overview of multidimensional poverty—levels and trends—in sub-Saharan Africa (SSA), using the most recent estimations and analyses of the global multidimensional poverty index (MPI). Apata et al. (2010) and Adeoti (2014) examined the trends and determinants of poverty in rural Nigeria. Yakubu et al. (2014) focused on multidimensional poverty analysis and informal sector in Nigeria. Deinne and Ajayi (2017) examined the spatial dynamics of urban poverty in Nigeria. While these studies have focused on patterns and determinants of poverty, the severity of multi-dimensional poverty at the household level measured multi-dimensionally has not been given much attention.

This paper examines the socio-spatial factors influencing the variation in the severity of multi-

dimensional poverty at the household level. Specifically, this paper examines the socio-spatial factors (location, accessibility, age at marriage, household structure, health status, employment status, ownership of assets, livelihood loss, level of education and remittances) influencing the severity of multi-dimensional poverty and determines the severity of multi-dimensional poverty among households in Delta state, Nigeria. The only hypothesis tested is that poverty severity experienced vary significantly among households in the study area.

Apart from this introduction, the rest of the paper is in five sections. Section two provides the theoretical and conceptual clarifications. The study area and methodology are provided in sections three and four while section five focuses on the various dimensions of poverty. The conclusion is provided in section six.

Theoretical and conceptual clarifications

The theoretical basis for this paper is derived from the sustainable livelihood framework in the absence of a grand theory to explain socio-spatial dynamics of multidimensional poverty. Conceptual clarification of approaches to poverty is also undertaken in this section.

Sustainable livelihood framework (SLF)

The sustainable livelihood framework which comprises people's assets (natural, physical, human, financial, social and information) and the complementary building blocks for their livelihoods in Fig. 1 provides the theoretical basis for this paper. Livelihood assets provide both a proxy for absolute poverty and a broader poverty measure (Erenstein 2009). Chambers and Conway (1992: 1) noted that "a livelihood comprises the capabilities, assets and activities required for a means of living". The approach serves as an instrument for the investigation of poor peoples' livelihoods while visualizing the main factors of influence which can be understood by qualitative and quantitative analysis at the local or communal level, regardless of where (i.e. which sector or geographical space,...) these factors occur.

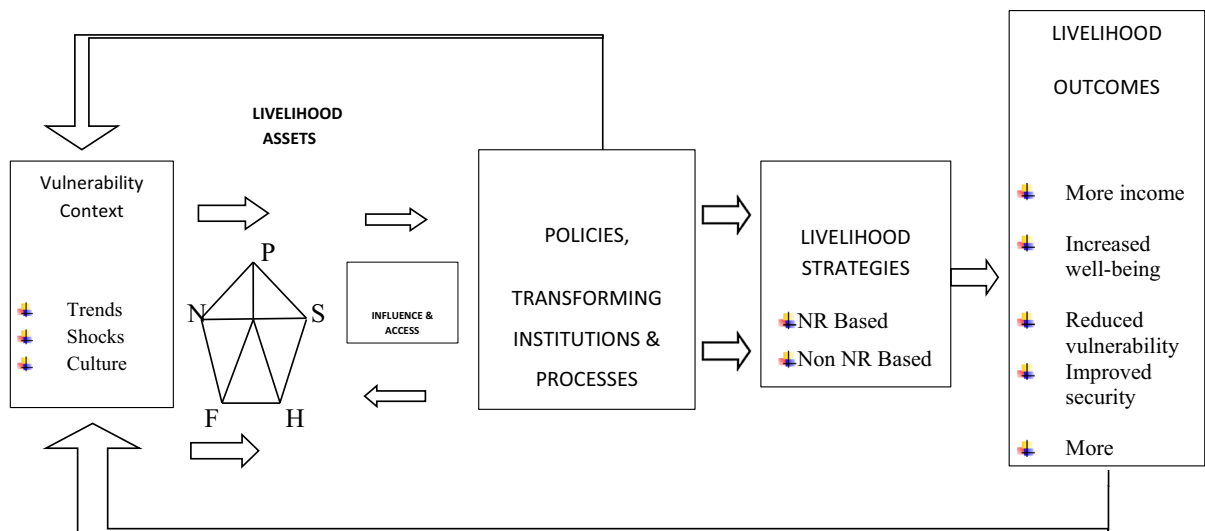


Fig. 1 Sustainable livelihoods framework (SLF). *NR* natural resources based livelihood strategies (farming, fishing, mining etc.); *Non-NR* non-natural resources based livelihood strategies

(business, civil servants etc.). *Source:* Adapted from Ashley and Carney (1999) and DFID (1999)

The five building blocks of sustainable livelihood

Sustainable livelihood is multi-dimensional, comprehensive and people-centred (Chang and Tipple 2009). The livelihood assets were conceptualised under the five building blocks of: physical asset/natural asset (shelter, energy, accessibility, sanitation and safe water, health care); social asset (membership of co-operative society, family support, relationship, friendship); financial asset (access to credit, loans, regular flow of money, savings and remittances); and human asset (knowledge, good health, skills, leadership). A major critique of sustainable livelihood is that there are too many components to address. Therefore, it has made it impossible to go in depth with any of these livelihoods thereby making the framework too broad and superficial (Clarke and Carney 2008).

The theory implies that access to the livelihood assets is mediated and influenced by transforming structures at different levels of government, private sector and civil society, processes such as laws and policies. Loan schemes and poverty alleviation strategies are also perceived to be contributing factors to household poverty status and poverty severity (see Fig. 1). Inadequate access to the assets and interest free loan schemes as a results of lack of information, lack of geographic access due to the swampy terrain and environmental issues, conflicts, illiteracy and ignorance lead to poor

health, high incidence of poverty and multiple deprivations experienced. In urban areas, the burden of increased demand and high expenditure on services has effects on access to education, nutrition, housing, health care and poor sanitations.

Conceptual clarification of approaches to poverty

Monetary and sustainable livelihood approaches are very central to dynamic and multi-dimensional poverty studies.

Monetary approaches to poverty

Monetary approaches are mostly used with poverty lines and can either be income-based or consumption-based. Currently, there are two estimates of income-poverty in wide use for assessing poverty especially in poor countries. The use of US \$1.25 a day by the World Bank is meant to encapsulate what income is required to purchase the absolute basics; the US \$2.00 a day poverty line is estimated by factoring in national poverty line data especially from lower-middle-income countries, thereby to some extent taking a less severe view on what are the socially and culturally acceptable minima. Given that exchange rates do not accurately reflect the differential purchasing power across countries, different purchasing power estimates

are commonly made and factored into the raw income figures to produce income level based on purchasing power parity (PPP).

Sustainable livelihoods approaches to poverty

Sustainable livelihoods became the focus of Department for International Developments (DFID) poverty alleviation policy (Solesbury 2003a, b). Sustainable livelihood approach is participatory and multi-dimensional in nature. According to Geiser et al. (2011), DFID explicitly aimed at “a refocus on assistance to the poor”. The pro-active, self-help image of the poor, the sustainable livelihoods thinking fits very well with the study of multi-dimensional poverty. The livelihood approach focused on how people organised their lives, on opportunities and on agency. The livelihood approach adopted in Delta State was also strongly motivated by the need to develop more effective poverty alleviation policies such as the introduction of multidimensional poverty reduction policies and strategies to help improve peoples’ livelihood and reduce poverty. More effectiveness was expected to come from bottom-up and participatory methods, putting emphasis on poor people’s lives and daily needs rather than from the top-down interventionist methods practiced so widely. In this respect, the livelihood approach was much indebted to the work and inspiration of Sen (1981); Chambers et al. (1989); Chambers and Conway (1992). It includes complex, diverse and dynamic strategies developed by households to meet their needs Gaillard et al. (2009).

Study area

Delta State is named after the delta of the River Niger and is situated in the region known as the Niger-Delta. The state is ethnically diverse and lies approximately between longitude 5°00' and 6°45' East of the Greenwich meridian and latitude 5°00' and 6°30' North of the Equator. The state is bounded by Ondo State to the northwest, Edo State in the north, Anambra State and River State to the east, Bayelsa State to the south and on the south western flank is the Bight of Benin. The choice of the study area is based on the fact that despite being one of the main source of oil exports for the country, this region suffers from poor infrastructure, sanitation, access to healthcare, and educational opportunities, difficulty in satisfying household needs as well as

inadequate investment in development. Environmental degradation from oil exploration and exploitation has contributed to and exacerbated a number of these problems. Among the states in Nigeria, Delta State has the highest level of unemployment with 20.8% in 2010 which increased to 27.2% in 2011, (NBS 2012), as unemployment increases wellbeing decreases more persons fall into poverty and increased deprivations (see Fig. 2).

Research methodology

A research survey design was adopted, while multi-dimensional poverty was measured based on deprivation headcount index of the global multi-dimensional poverty (MPI) along education, health and living standard.

Sampling technique

A multi-stage sampling technique involving four steps was used to select households for the survey. At the first stage, Delta State was purposively selected, while the twenty-five (25) local government areas that make up the state were involved in this study. At the second stage, a town in each local government area was selected by systematic random sampling. At the third stage, 2521 households involved in the study were randomly selected while at the fourth stage, the questionnaire was administered to household heads in each of the selected households. Households in each local government area across the state were further reclassified into three senatorial districts to ease analysis and interpretations.

Measurement of poverty indicators

There are three main ways of measuring what happens to poverty over space and time. They include appropriate questions in a single cross-section survey, repeated cross-sectional surveys, and panel data. Given the attrition and paucity of longitudinal survey data needed for this kind of analysis, this paper adopted cross-section survey to generate data on the sampled households at a single point in time. The household survey was preceded by a pilot survey and training of field assistants to enhance the validity of survey instruments.

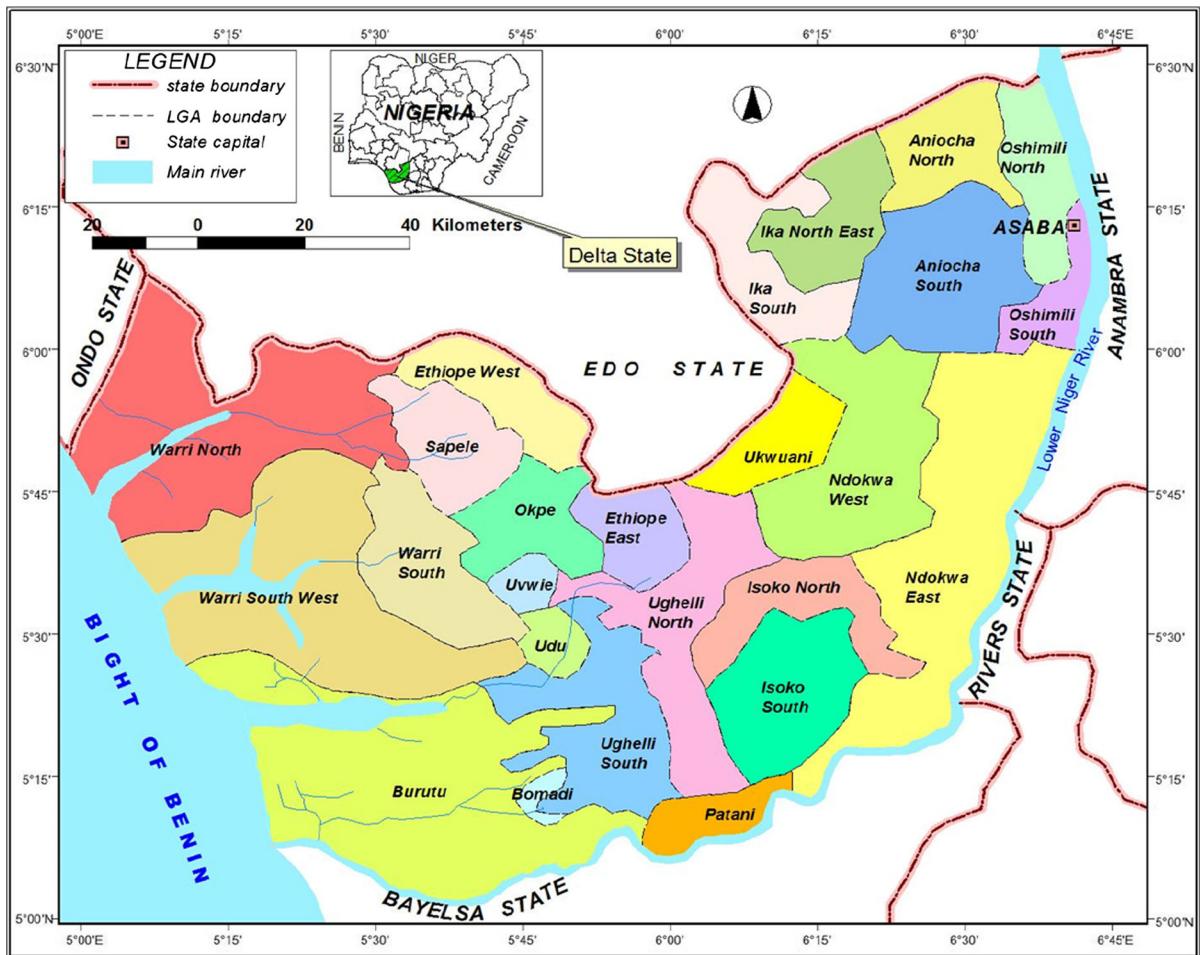


Fig. 2 Study area

Multidimensional poverty index (MPI)

The multidimensional poverty index (MPI) was adopted. The rationale for the use of MPI thresholds are diverse: MPI assesses the nature and severity of poverty at the individual and household level, with poor people being those who are deprived and the extent or severity of their poverty being measured by the extent of their deprivations. MPI incorporates key services such as water and sanitation, electricity, education level, and housing which are not consistently captured in all income and consumption surveys. The MPI has ten indicators, two each for health domain and education domain, while six for livelihood asset domain (UNDP 2012).

Furthermore, the chosen indicators were affected by the available household survey data derived from

urban households in the study area. Multidimensional poverty construct is measured through the aggregation of different deprivation variables experienced by the households. The index reflects deprivations and various patterns of poverty severity and show aspects in which they are deprived and help reveal the interconnections among deprivations.

Instead of the ten (10) indicators used in the global MPI, twenty-three (23) indicators were used in this paper, three proxy indicators of health deprivation were used under the health dimension (health status/health related losses experienced and nutrition measured as consumption expenditure of household heads), and two indicators of education deprivation under the education dimension measured as (primary education and no formal education), while eighteen (18) indicators were used within the standard of living

dimension such as: unimproved cooking fuel, unimproved sanitation, unimproved energy source, lack of

Percentage of the proportion of indicators in which the poor are deprived is:

$$A(\%) = \frac{\text{proportion of indicators/dimensions in which the poor are deprived}}{\text{Sum of all indicators/dimensions}} \times 100 \quad (4)$$

access to safe clean water, accessibility/good road, quality housing, poor sanitation, livelihood assets, unemployment, dependence on financial assistance and remittances for survival.

These deprivations are defined based on the Harmonised Nigeria Living Standard Survey (2010); Millennium Development Goals (2010); UNDP (2010) definitions. While an equal weight of 1 was assigned to all the variables used in the multiple deprivation index. The MPI was developed by Alkire and Santos (2010) and presented in the Human Development Report (2012).

Calculation of headcount ratio (H) and poverty severity (A)

The MPI is calculated as the product of two numbers: The percentage of people involved and the “average intensity of deprivation” which reflects the number of dimensions in which households are deprived. The proportion of the population that is multi-dimensionally poor determines the incidence of poverty or headcount ratio (H), while the proportion of indicators in which the poor are deprived determines the severity of their poverty (A).

The technique for calculating the MPI poor is given by:

$$\text{MPI} = H \times A \quad (1)$$

where $H = \frac{q}{n}$, q = number deprived or poor, n = population size

Percentage of household deprived in each indicator

$$= \frac{\text{Number of poor or deprived}}{\text{Total Number of households surveyed}} \times 100 \quad (2)$$

The proportion of indicators in which the poor are deprived (A) is computed thus:

$$A = \frac{\text{Number of indicators/dimensions in which the poor are deprived}}{\text{Sum of all indicators/dimensions}} \quad (3)$$

One implication of the approach is that households are described by counting the number of deprivations suffered (headcount index). A general equal weight of one ($w_j = 1$) was assigned to all variables within each dimension as measures of deprivation based on the rationale that an equal weight gives equal importance to each dimension. The justification for applying equal weight of (1) one is that each indicator is weighted equally along each dimension irrespective of its nature and the number of indicators used to describe each dimension introduces objectivity and prevents one dimension from being too important than other dimensions and eases analysis and interpretation (see Table 1).

In addition, poverty cut-off of 50% was adopted which represents k value—the minimum proportion of weighted domains in which a person has to be deprived to be identified as multi-dimensionally poor. The 50% deprivation cut-off indicates multi-dimensionally poor households are deprived in more than half of the indicators. Hence, the higher the deprivation cut-off the more severe the poverty situation of deprived households (Alkire and Foster 2010).

Discussion of results and findings

Deprivations in Education Dimension

The extent of human poverty in each household is represented by current and future levels of education deprivations. Two measures, illiteracy or heads of household without formal education and household heads with just primary school education are indicators of education deprivation included in the construction of education dimension of MPI poverty. The most

Table 1 Thresholds and weights of variables

Dimensions/variables	Thresholds	(AF) Equal weights
Education dimension	Households without basic education	Education dimension
No formal education		1/2 = 0.5
Primary education		1/2 = 0.5
Health dimension	ill-health and nutrition was measured as consumption expenditure of households based	Health dimension
Health status	Households are considered deprived if head experienced ill-health	1/3 = 0.3
Nutrition (consumption expenditure based on \$1.25)	Nutrition was measured as consumption expenditure of households based on \$1.25 and \$2 thresholds.	1/3 = 0.3
Nutrition (consumption expenditure based on \$2.00)		1/3 = 0.3
Living standard dimension	Employment, energy, sanitation and waste disposal method, water source, remittances, ownership of asset	Living Standard
Employment status of household heads, adults (18 years)	Unemployed household heads and unemployed adults above 18 years	1/18 = 0.06
Remittances	Households that depend on remittances	1/18 = 0.06
Livelihoods	Households that experienced lose such as job, tools, goods and properties	1/18 = 0.06
Ownership of assets	household were considered deprived if it had less than or equal to one of radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck	1/18 = 0.06
Ownership of decent accommodation (housing)	Ownership of decent accommodation, while non-decent accommodation are considered deprived	1/18 = 0.06
Accessibility	Areas not accessible by roads and areas with less density of road networks are considered deprived	1/18 = 0.06
Kerosine as energy source	Households using firewood, charcoal as source of lighting without electricity, solar and other improved sources, are considered deprived	1/18 = 0.06
Generator as energy source		1/18 = 0.06
Candle as energy source		1/18 = 0.06
Water vendor as water source	A household is considered deprived if the household does not use piped water, tube well and well which are the improved sources and considered deprived if households travel over a considerable distance to fetch water (> 500 m)	1/18 = 0.06
Well as water source	A household is considered deprived if the household does not use piped water, tube well and well which are the improved sources and considered deprived if households travel over a considerable distance to fetch water (> 500 m)	1/18 = 0.06
Rivers and streams water source	Household using unimproved sanitation facilities such as pit latrine, bucket toilet and hanging toilet. Households without improved toilet facilities	1/18 = 0.06
Pit-latrine as toilet		1/18 = 0.06
Bush		1/18 = 0.06
River		1/18 = 0.06
Truck pushers for waste disposal	Households without improved sanitation facilities or poor waste disposal system.	1/18 = 0.06
Roadside		1/18 = 0.06
Drainage		1/18 = 0.06
Bush		1/18 = 0.06

deprived households in the education dimension are concentrated in Burutu local government with a headcount index of (28) representing 0.6% of multi-

dimensionally poor households followed by households in Ughelli south with a headcount index of (21) representing 0.4% of multi-dimensionally poor

households, Ethiope east (16) 0.3%, Ughelli north (15) 0.3% Warri south (10) 0.2% and Ethiope west (10) 0.2% respectively.

On the other hand, the least deprived and less multi-dimensionally poor households in the education dimension are found in the town of Asaba and Ibusa in Oshimili north and Oshimili south with a head count index of (1) in each town representing 0.02% of multi-dimensionally poor households. Accessibility to basic amenities like education facilities in Asaba and Ibusa communities influenced the low level of deprivation experienced in the educational domain compared to communities with limited access to basic amenities which results to high level of deprivation experienced in the educational domain (see Fig. 3).

Deprivations in Health Dimension

Three proxy indicators were used for the computation of health deprivation experienced by household members in the health domain are: The first two indicators looks at nutrition of household members measured as consumption expenditure of households at (a) \$1.25 and (b) \$2.00 respectively, while the third indicator was measured as health related losses experienced by household heads in the study area. The most deprived and multi-dimensionally poor households in the health dimension are concentrated in delta south senatorial district which is made up of Warri South with a headcount index of (157) representing 2.1% of multi-dimensionally poor households,

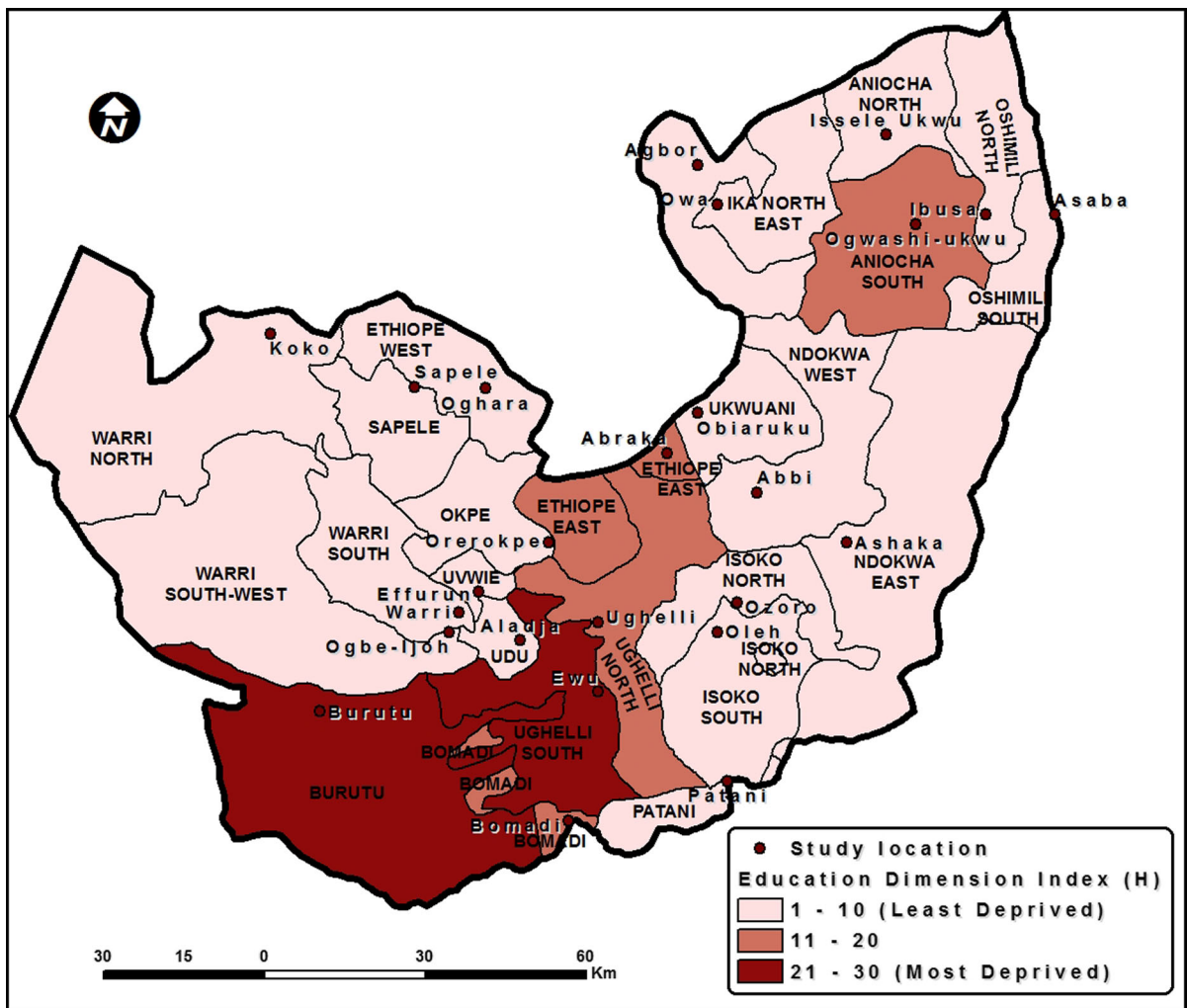


Fig. 3 Deprivation in education

followed by Burutu (134) 1.8%, Ewu (119) 1.6%, Ozoro (117) 1.5%, Effurun (115) 1.5%, Oleh (106) 1.4%, Ashaka (106) 1.4%, Owa (98) 1.2%, Obiaruku (94) 1.2%, while the least deprived households in the health domain are found in the towns of Asaba and Ibusa in delta north senatorial district with a headcount index of (20) representing 0.3% of multi-dimensionally poor households and (28) representing 0.4% of multi-dimensionally poor households respectively (see Fig. 4).

Deprivations in the standard of living dimension

The standard of living thresholds based on MDG’s and HNLSS (2010) was used to identify household

deprivations measured as multi-dimensionally poor, the deprivation scores for each household are summed to obtain the household deprivation in the standard of living domain. Household deprivations in the standard of living domain are measured as: households with no electricity, households using wood or kerosene, oil as cooking fuel, households with no safe drinking water and unimproved energy sources, no access to adequate sanitation such as unhygienic waste disposal methods, using ‘dirty’ cooking fuel, unimproved energy source (wood or charcoal), having a home with a dirty floor and non-ownership of house and non-ownership of essential household assets are added to the list of variables used to assess households’ poverty severity in the living standard domain.

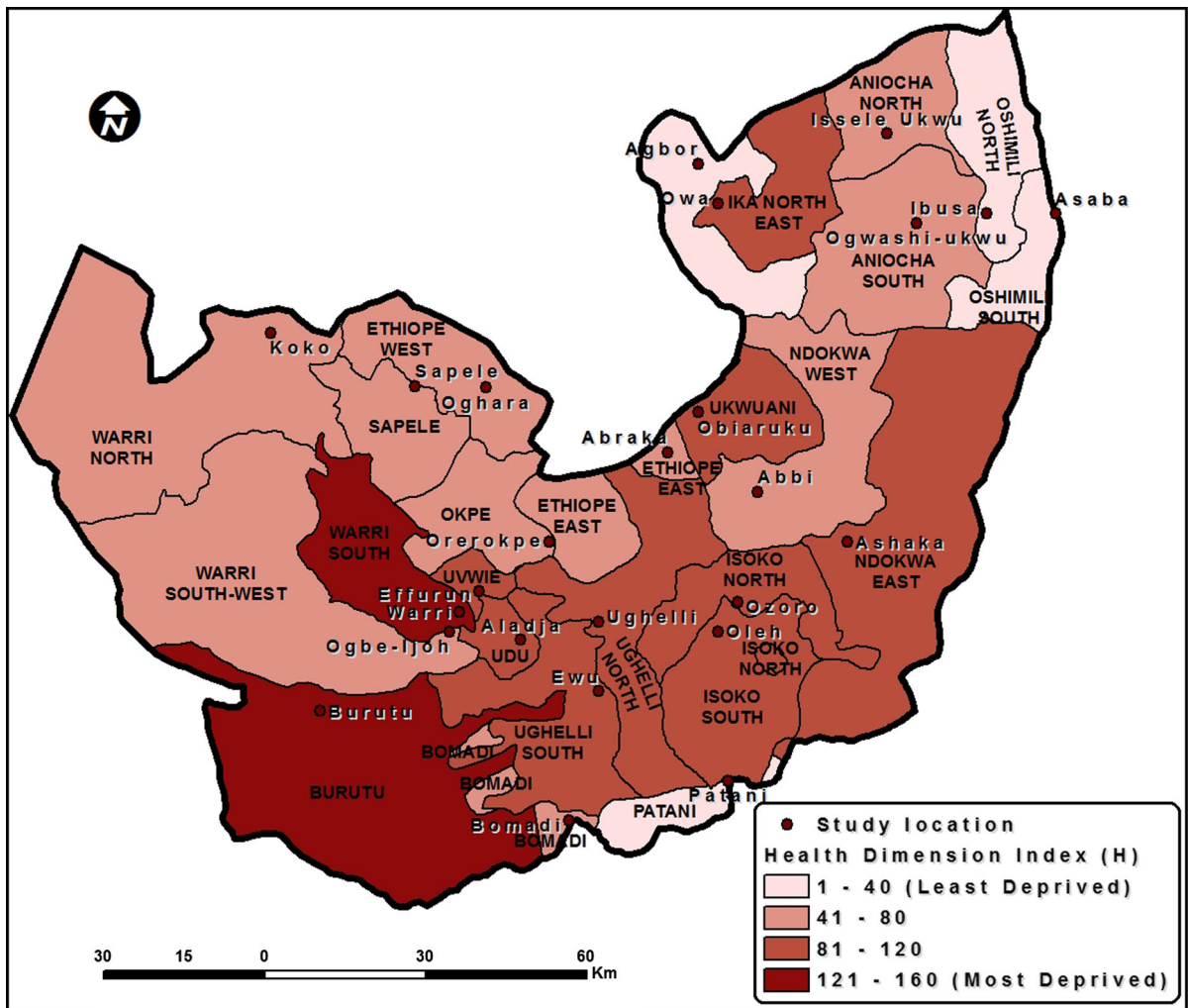


Fig. 4 Deprivation in health

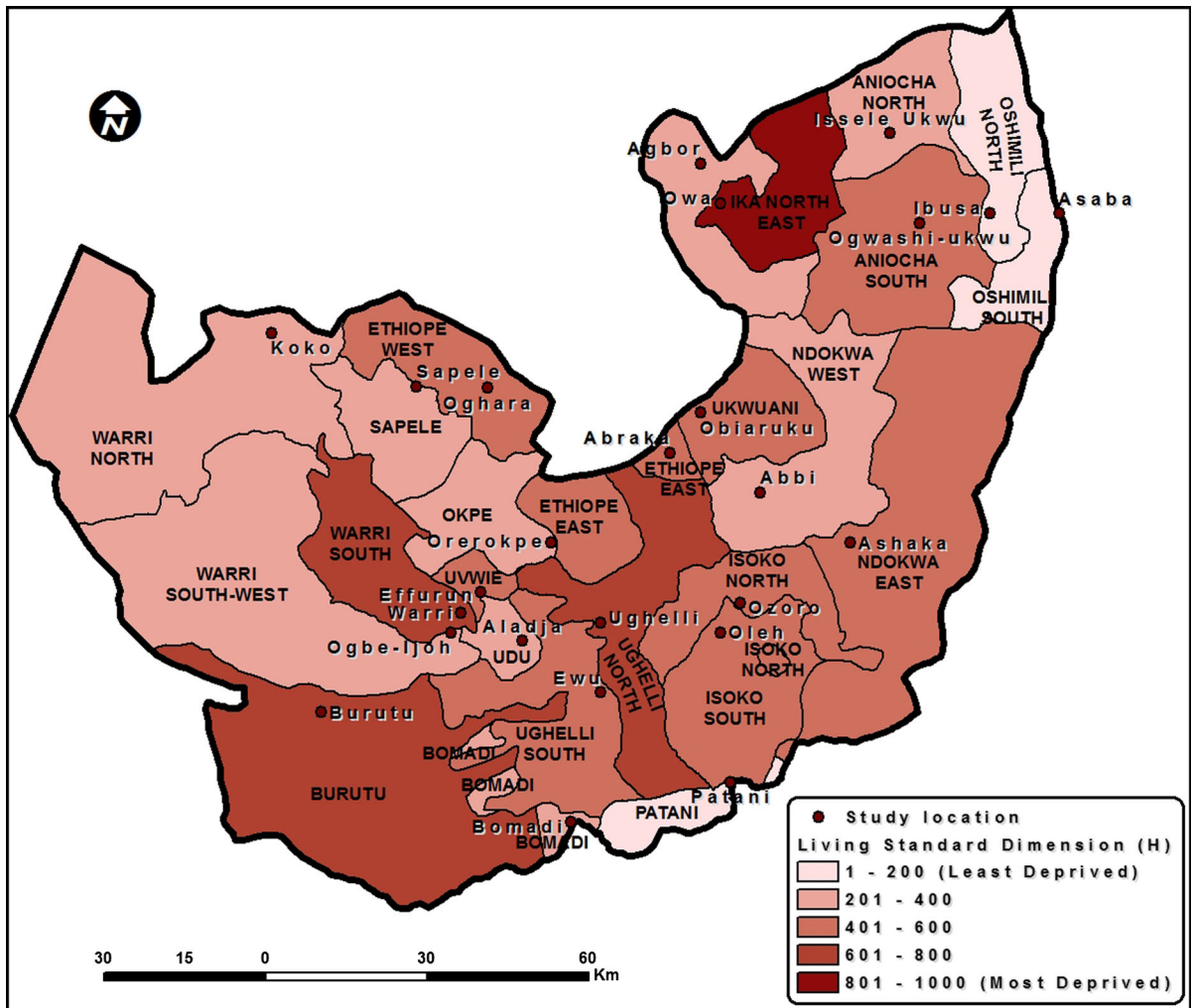


Fig. 5 Deprivation in living standard

Owa in Ika north east had the most deprived households in the living standard domain with a headcount index of (871) and a severity index of 2.1% of multi-dimensionally poor households, followed by Warri (685) 1.6%, Ughelli (619) 1.5%, Burutu (616) 1.4%, Ozoro (596) 1.4%, Ewu (565) 1.3%, and Oleh (505) representing 1.2% of multi-dimensionally poor households, while the least deprived and least multi-dimensionally poor households in the living standard dimension are found in the towns of Asaba and Ibusa in Oshimili north and Oshimili south with a headcount index of (99) and (144) and severity index of 0.2% and 0.3% of multi-dimensionally poor households respectively.

The variations observed among households deprivation in the living standard dimension is a reflection of administrative function and commercial function performed by Asaba as the seat of government and availability of socio-economic infrastructure which provides opportunities for the poor and improves livelihood, and the likelihood of transition from poverty and of course, the proximity of Ibusa to Asaba influences the relatively low level of deprivations and multi-dimensional poverty experienced in the standard of living domain (see Fig. 5).

Table 2 Disaggregate of poverty severity at the senatorial district level

Senatorial districts	LGAs	Headcount ratio (education)	Weighted (H) (education)	Headcount ratio (health)	Weighted (H) (health)	Headcount ratio (living standard)	Weighted (H) (living standard)	(MPI) poverty Index	A intensity	(HX A) severity index	Percent (%) (HXA)	Poverty cut off 0.5/(50%)	Headcount H
Delta North	Aniocha North	0.00198334	0.00099167	0.01824673	0.006021421	0.1094804	0.006568822	0.013582	0.9130	0.01240037	1.24	0.006791	0.1297
	Aniocha South	0.00515668	0.002578342	0.03173344	0.01047204	0.1808806	0.01085284	0.023903	0.9130	0.021823439	2.18	0.0119515	0.2178
	Oshimili North	0.00039667	0.000198334	0.0111067	0.003665211	0.0571202	0.003427211	0.007291	0.6522	0.00475519	0.47	0.0036455	0.0686
	Oshimili South	0.00039667	0.000198334	0.00793336	0.002618009	0.0392701	0.002356208	0.005173	0.6522	0.003373831	0.34	0.0025865	0.0476
	Ika Northeast	0.00357001	0.001785006	0.03887346	0.01282824	0.3454978	0.02072987	0.035343	0.8696	0.030734273	3.07	0.0176715	0.3879
	Ika South	0.00158667	0.000793336	0.01428005	0.004712416	0.1404205	0.008425228	0.013931	0.7391	0.010296402	1.03	0.0069655	0.1563
	Ndokwa East	0	0	0.04204681	0.01387545	0.1769139	0.01061484	0.02449	0.8261	0.020231189	2.02	0.012245	0.219
	Ndokwa West	0.00238001	0.001190004	0.02935343	0.009686632	0.1281238	0.007687426	0.018564	0.9130	0.016948932	1.69	0.009282	0.1599
	Ukwani	0.00357001	0.001785006	0.03728679	0.01230464	0.2142007	0.01285204	0.026942	0.9565	0.025770023	2.57	0.013471	0.2551
	Total	0.01904006	0.009520032	0.23086077	0.076184059	1.391908	0.083514485	0.169219	7.4347	0.146333649	14.63	0.0846095	–
Delta Central	Average	0.002115562	0.001057781	0.025651197	0.008464895	0.154656	0.009279387	0.018802	0.826078	0.016259294	1.62	0.009401056	–
	Ethiopia West	0.00396668	0.00198334	0.02578342	0.008508529	0.1781039	0.01068624	0.021178	0.7391	0.01565266	1.56	0.010589	0.2079
	Ethiopia East	0.00634669	0.003173344	0.02300674	0.007592224	0.193574	0.01161444	0.02238	0.9130	0.02043294	2.04	0.01119	0.2229
	Okpe	0	0	0.02261008	0.007461326	0.1019437	0.00611662	0.013578	0.7826	0.010626143	1.06	0.006789	0.1246
	Sapele	0	0	0.03014677	0.009948434	0.1301071	0.007806426	0.017755	0.8261	0.014667406	1.47	0.0088775	0.1603
	Udu	0.00079334	0.000396668	0.03252678	0.01073384	0.1261404	0.007568425	0.018699	0.6957	0.013008894	1.30	0.0093495	0.1595
	Ughelli North	0.00595002	0.00297501	0.03332011	0.01099564	0.2455375	0.01473225	0.028703	0.7391	0.021214387	2.12	0.0143515	0.2848
	Ughelli South	0.00833003	0.004165014	0.04720349	0.01557715	0.2241174	0.01344704	0.033189	0.9565	0.031745279	3.17	0.0165945	0.2797
	Uvwie	0	0	0.04561682	0.01505355	0.1753273	0.01051964	0.025573	0.5652	0.01445386	1.45	0.0127865	0.2209
	Total	0.02538676	0.012693376	0.26021421	0.085870693	1.3748513	0.082491081	0.181055	6.2173	0.141801569	14.18	0.0905275	–
Average	0.003173345	0.001586672	0.032526776	0.010733837	0.1718564	0.010311385	0.022631	0.77715	0.017725196	1.78	0.011315938	–	

Table 2 continued

Senatorial districts	LGAs	Headcount ratio (education)	Weighted (H) (education)	Headcount ratio (health)	Weighted (H) (health)	Headcount ratio (living standard)	Weighted (H) (living standard)	(MPI) poverty Index	A intensity	(HX A) severity index	Percent (%) (HXA)	Poverty cut off 0.5/(50%)	Headcount H
Delta South	Burutu	0.0111067	0.00555335	0.05315351	0.01754066	0.2443475	0.01466085	0.037755	0.9565	0.036112658	3.61	0.0188775	0.3087
	Bomadi	0.00515668	0.002578342	0.02221341	0.007330425	0.1047204	0.006283221	0.016192	0.9130	0.014783296	1.47	0.008096	0.1321
	Isoko North	0.00357001	0.001785006	0.04641012	0.01531535	0.2364141	0.01418485	0.031285	0.8696	0.027205436	2.72	0.0156425	0.2864
	Isoko South	0	0	0.04204681	0.01387545	0.2003173	0.01201904	0.025894	0.8261	0.021391033	2.13	0.012947	0.2424
	Patani	0.00079334	0.000396668	0.0111067	0.003665211	0.0658469	0.003950813	0.008013	0.7826	0.006270974	0.62	0.0040065	0.0777
	Warri North	0.00158667	0.000793336	0.02737009	0.00903213	0.1170171	0.007021024	0.016846	0.7826	0.01318368	1.31	0.008423	0.146
	Warri South	0.00396668	0.00198334	0.06227687	0.02055137	0.27117176	0.01630305	0.038838	0.9565	0.037148547	3.71	0.019419	0.338
	Warri Southwest	0.00357001	0.001785006	0.02459342	0.008115829	0.1166204	0.006997223	0.016898	1	0.016898	1.68	0.008449	0.1448
Total		0.02975009	0.014875048	0.28917093	0.095426425	1.3570013	0.081420071	0.191721	7.0869	0.172993624	17.29	0.0958605	-
Average		0.003718761	0.001859381	0.036146366	0.011928303	0.1696251	0.010177509	0.023965	0.88525	0.021624203	2.16	0.011982563	-

Disaggregated poverty severity

Table 2 disaggregates the distribution of the severity of poverty at the senatorial district level. Multi-dimensional poverty measured as multiple deprivations simultaneously experienced along education, health and living standard domains. Although, household poverty in the study area is essentially chronic and multi-dimensional in nature with most of the households being deprived in more than k-value of 50% of the multi-dimensional indicators adopted in this paper.

The most deprived households are found in delta south senatorial district with a severity index of (0.1729) representing (17.29%) of sampled households, followed by delta central senatorial district with a severity index of (0.1418) representing (14.18%) of sampled households, while delta north senatorial district had a severity index of (0.1463) representing (14.63%) of sampled households. The average severity index of 0.01625 (1.62%), 0.01773 (1.78%) and 0.02162 (2.16%) was recorded for delta north, delta central and delta south respectively, while an average severity index of 0.018445 representing (1.84%) was computed for the state as a whole. This result reveals that households in delta south senatorial district are the most severely deprived along education, health and living standard domains adopted.

The most severely poor households were found in delta south which is made up of Warri South with multi-dimensional poverty index of 0.0371 representing (3.71%) of sampled households. However, the least severely deprived households are found in delta north which is made up of Oshimili south with a severity index of 0.0034 representing (0.34%) of sampled households along education, health and living standard dimensions. Multiple deprivations in the living standard domain contributed most to the severity of poverty among the three senatorial districts followed by deprivations in the health domain. A significant proportion of the households are multiply deprived in the following indicators under the living standard domain: sanitation and toilet facilities, unsafe water sources, no assets, experienced livelihood losses (job, spouse, tool, equipment etc.), unimproved energy sources, and unemployment. Household poverty indices, like housing, health, drinking water, sanitation facilities and garbage collection system, are in

deplorable conditions in most of these urban centres (see Table 2, for more details).

Socio-spatial dynamics of poverty severity

The hypothesis that the severity of household poverty varies significantly among households in the study area is tested using analysis of variance (ANOVA), while PCA reduced the observed variables into a smaller number of principal components that accounted for most of the variance in the observed variables. The principal component analysis reduced the observed variables into seven orthogonal variables which together accounted for 54.5% of the total variations. The extracted principal components 1, 2, 3, 4, 5, 6, 7, explained 10.451, 10.085, 9.309, 8.431, 6.793, 6.389 and 6.081% respectively. The first component can be described as a measure of sanitation, as it correlates strongly with unimproved sanitation facilities, waste disposal methods and unhealthy water source with component loadings of (0.772, 0.687 and 0.625). These loadings imply that increased unimproved sanitation facilities, poor water sources and waste disposal methods suggest a high deprivations and increased severity of poverty.

The second principal component is strongly correlated with unemployed adults above 18 years of age with a component loading of 0.737, poor nutrition 0.550 and location of households with a component loading of -0.601 . This implies that poverty severity increases with an increase in the number of unemployed adults and increased malnutrition, while poverty severity decreases with improved accessibility and good location with basic amenities. The second component could be described as a measure of wellbeing and livelihoods of households. The third principal component correlates with household composition measured as marital status and number of children with component loadings of 0.714 and 0.699.

The fourth principal component correlates with age of marriage with a loading of 0.527 which implies that poverty severity is significantly influenced by age at marriage, while employment of household heads decreases the severity of poverty with a component

loadings of -0.719 . This is an indication that poverty severity decreases with increase in the employment of household heads. The fifth principal component correlates with the domestic remittances received by households with a loading of 0.611, dependency on remittances increases the severity of poverty.

The sixth principal component correlates with gender of households with a loading of 0.868, which implies that gender significantly influences poverty severity, while the seventh principal component correlates with the health status of household heads with a loading of 0.854 which implies that ill-health of household heads influences the severity of poverty (see Table 3).

Table 4 shows the result of the analysis of variance (ANOVA) based on further analysis of the extracted components in the principal component analysis (PCA). The result shows that the contribution of the high component loadings to the variations in the distribution of household poverty severity is statistically significant at ($p \leq 0.001$) significance level with F value of ($F = 527.305$).

Conclusion

A significant proportion of severely deprived and multi-dimensionally poor households are concentrated in communities of delta south senatorial district and delta central senatorial districts based on the MPI multi-dimensional measures adopted. This study found that the geographic variation in urban poverty severity is due to variations in the deprivations of socio-spatial dynamics, such as availability of natural resource, geographic access to basic facilities, location, distance to water source and sanitation facilities. Proper understanding of the different poverty categories, multi-dimensional nature of poverty and identification of the chronic poor and multi-dimensionally poor to enable the inclusion of the poor in the formulation of pro-poor policies is vital to successful implementation of poverty reduction programmes in Nigeria. This study, apart from contributing to the growing literature on poverty studies in Nigeria,

Table 3 Summary of the Principal component analysis

Variables	Components						
	1	2	3	4	5	6	7
Gender	0.041	0.086	0.005	0.018	− 0.006	0.868	0.071
Highest education of household head	− 0.392	0.406	− 0.381	− 0.005	− 0.426	0.023	0.056
Marital status of household heads	− 0.109	0.091	0.714	0.051	− 0.019	0.092	− 0.031
Source of water for household	0.625	0.356	0.127	0.213	0.115	− 0.063	0.058
Distance to water source	0.331	− 0.250	− 0.272	− 0.031	− 0.456	− 0.170	0.190
Sanitation and toilet facilities	0.772	0.004	− 0.003	− 0.097	0.014	0.127	− 0.017
Method of waste disposal	0.687	− 0.007	− 0.170	− 0.129	− 0.257	− 0.051	− 0.031
Age at marriage	0.036	0.050	0.240	0.527	0.101	− 0.178	− 0.068
Number of children	0.042	0.217	0.699	0.294	− 0.011	− 0.057	− 0.057
Employment status of households	0.126	0.008	− 0.026	− 0.719	0.214	− 0.161	− 0.116
Adults above 18 years unemployed	0.062	0.737	0.097	0.052	0.104	− 0.080	0.001
Ownership of assets	− 0.001	− 0.260	0.084	− 0.266	− 0.286	0.330	− 0.053
Loss of livelihoods	− 0.069	− 0.096	− 0.432	0.357	0.376	0.214	− 0.401
Ill health	− 0.011	− 0.054	− 0.078	0.093	0.142	0.091	0.854
Location	− 0.080	− 0.601	− 0.120	0.047	− 0.022	− 0.152	0.075
Consumption expenditure	− 0.045	0.550	0.156	0.494	0.000	− 0.080	0.076
Remittances received	− 0.059	0.086	− 0.119	− 0.143	0.611	− 0.111	0.242
Eigen values	1.777	1.714	1.583	1.433	1.155	1.086	1.034
Percentage variance (%)	10.451	10.085	9.309	8.431	6.793	6.389	6.081
Cumulative explanation (%)	10.451	20.537	29.846	38.277	45.069	51.458	57.540

Extraction method: principal component analysis

Rotation method: varimax with Kaiser normalization

Source: Authors analysis

Table 4 Summary of ANOVA

Model	Sum of square	df	Mean square	F	Sig.
1 Regression	1212.186	7	173.169	527.305	0.001
Residual	824.624	2511	0.328		
Total	2036.811	2518			

Dependent variable: MPI poor (poverty severity)

Predictors: (constant), regression component score 1, regression component score 2, regression component score 3, regression component score 4, regression component score 5, regression component score 6, regression component score 7

identified the geographic dimension of multi-dimensional poverty over space in a cross-sectional household survey.

Compliance with ethical standards

Conflict of interest Both authors declare that they have no conflict of interest.

References

- Abiola, A. G., & Olaopa, O. R. (2008). Economic development and democratic sustenance in Nigeria. In E. O. Ojo (Ed.), *Challenges of sustainable democracy in Nigeria* (pp. 25–34). Ibadan: John Archers Publishers Limited.
- Adeoti, A. I. (2014). Trend and determinants of multidimensional poverty in rural Nigeria. *Journal of Development and Agricultural Economics*, 6(5), 220–231.
- Akerele, D., & Adewuyi, S. A. (2011). Analysis of poverty profiles and socioeconomic determinants of welfare among

- urban households of Ekiti State, Nigeria. *Current Research Journal of Social Sciences*, 3(1), 1–7.
- Alayande, B. & Alayande, O. (2004). A quantitative and qualitative assessment of vulnerability to poverty in Nigeria. A paper submitted for presentation of CSAE conference on poverty reduction, growth and human development in Africa, March, 2004.
- Alkire, S., & Foster, J. (2010). Counting and multidimensional poverty measurement. *Journal of Public Economics*, 95(7), 476–487.
- Alkire, S., & Housseini, B. (2014). Multidimensional poverty in sub-Saharan Africa: Levels and trends. OPHI working paper, 81. Oxford University.
- Alkire, S. & Santos, M. E. (2010). Acute multidimensional poverty: A new index for developing countries. Oxford poverty and human development initiative working paper, 38. <http://www.ophi.org.uk/publications/ophi-working-papers/>.
- Apata, T. G., Apata, O. M., Igbalajobi, O. A., & Awoniyi, S. M. O. (2010). Determinants of rural poverty in Nigeria: Evidence from small holder farmers in South-Western, Nigeria. *Journal of Science and Technology Education Research*, 1(4), 85–91.
- Ashley, C., & Carney, D. (1999). *Sustainable livelihoods: Lessons from early experience*. London: Department for International Development.
- Chambers, R., & Conway, G. R. (1992). *Sustainable rural livelihoods: Practical concepts for the 21st century*. Discussion paper 296. Brighton, UK: Institute of Development Studies.
- Chambers, R., Pacey, A., & Thrupp, L. A. (1989). *Farmer first: Farmer innovation and agricultural research* (pp. 55–61). London: Intermediate Technology Publications Ltd.
- Chang, Y., & Tipple, G. (2009). Realities of life and housing in a poor neighbourhood in urban China: Livelihoods and vulnerabilities in Shanghai Lane, Wuhan. *International Development Planning Review*, 31(2), 165–198.
- Clarke, J., & Carney, D. (2008). Sustainable livelihoods approaches—What have we learned? Background paper, ESRC livelihoods seminar, 13 October. Livelihoods Connect.IDS: Brighton.
- Deinne, C. E., & Ajayi, D. D. (2017). Spatial dynamics of urban poverty in Delta State, Nigeria. *Journal of Poverty*, 22(3), 269–286.
- Department for International Development (DFID). (1999–2001). Sustainable livelihoods guidance sheets. Department for International Development. Retrieved November 4, 2009.
- Edoumiekumo, S. G., Tombofa, S. S., & Karimo, T. M. (2013). Multidimensional energy poverty in the South-South Geopolitical Zone of Nigeria. *Journal of Economics and Sustainable Development*, 4(20), 96–103.
- Erenstein, O. (2009). *Livelihood assets as a multidimensional inverse proxy for poverty: A district level analysis of the Indian Indo-Gangetic Plains*. Working paper. New Delhi: CIMMYT
- Gaillard, J., Maceda, E., Stasiak, E., Le Berre, I., & Es-paldon, M. (2009). Sustainable livelihoods and people's vulnerability in the face of coastal hazards. *Journal of Coastal Conservation*, 13(2), 119–129.
- Geiser, U., Bottazzi, P., Epprecht, M., Fakou, G., Fritschi, A., Ramakumar, R., Shahbaz, B., Steimann, B., & Strasser, B. (2011). Access to livelihood assets: Inclusion, exclusion, and the reality of development interventions. In: U. Wiesmann & H. Hurni (Eds.), *Research for sustainable development: Foundations, experiences, and perspectives* (pp. 313–330). Perspectives of the Swiss National Centre of Competence in Research (NCCR) North-South. Geographica Bernensia 6. Bern.
- Ifelunini, I. A., Jonah, T. A., Wosowei, E. C., & Otens, S. (2013). Multidimensional poverty, incidence in Nigeria: Empirical insight from core welfare indicator questionnaire (CWIQ) survey. *Journal of Economics and Sustainable Development*, 4(16), 105–112.
- Nigeria Bureau of Statistics (NBS). (2012). Population and housing census. Issued March (pp. 34–36).
- Okunmadewa, F. Y., Yusuf, S. A. & Omonona, B. T. (2005). Social capital and poverty reduction in Nigeria. Revised report submitted to Africa Economic Research Consortium (AERC) Nairobi, Kenya.
- Oyekale, T. O., & Oyekale, A. S. (2013). Assessment of multidimensional poverty in rural and urban Nigeria: Evidence from demographic and health survey (DHS). *Journal of Human Ecology*, 42(2), 141–154.
- Sen, A. (1981). *Poverty and famines. An essay on entitlement and deprivation*. Oxford: Oxford University Press.
- Solesbury, W. (2003a). *Sustainable livelihoods: A case study of the evolution of DFID policy*. London: Overseas Development Institute.
- Solesbury, W. (2003b). The sustainable livelihoods case study. Bridging research and policy seminar. Transcript of presentation given at Overseas Development Institute, London (9 October).
- The Millennium Development Goals Report. (2012). United Nations. New York (p. 35).
- The Nigeria Poverty Profile. (2010). Report press briefing by the statistician-general of the federation/chief executive. National Bureau of Statistics (NBS) Press Briefing on Nigeria Poverty Profile Report (Vol. 1, p. 5).
- United Nations Development Programme. (2012). *Human development report*. New York: Oxford University Press.
- World Bank. (2000). *Making transition work for everyone: Poverty and inequality in Europe and Central Asia*. Washington, DC: World Bank.
- Yakubu, A. T., Mobolaji, H. I., Ijaiya, G. T., Kilishi, A. A., & Yaru, M. A. (2014). Multidimensional poverty analysis and informal sector in Nigeria. *European Journal of Business and Management*, 6(37), 354–361.