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Analysis of the Incidence and Distribution Pattern of Poverty in Akwa Ibom State, Nigeria; Using Geographic Information Systems Techniques

by

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Abstract

This study investigated the incidence of poverty in Akwa Ibom State, Nigeria using Geographic Information Systems Techniques/technology. The study used questionnaire to elicit responses from households who were randomly selected through a multi-stage sample technique from the study area. The questionnaire was a composite questionnaire measuring indicators of poverty. Series of analytical techniques were used. To measure poverty. The Foster-Greer-Thorbecke (FGT) poverty indices namely headcount index, poverty gap index and poverty severity index were used. The results of these measures were mapped in order to show the distribution pattern of the incidence of poverty in the area. Also, spatial autocorrelation analysis was used to determine the spatial pattern of the incidence of poverty in the area. Spatial autocorrelation is a method for detecting spatial patterns of a point distribution by considering both the locations of the points and their attributes [in this case, poverty incidence]. The result indicated that poverty incidence was high and randomly distributed within the study area. The development and use of GIS for mapping to enhance targeting the poor was one of the recommendations to eradicate/reduce the incidence of poverty in the Study area.

Key words: Poverty, Geographic Information Systems, Headcount index, poverty gap index, distribution pattern, surface mapping.

1. Introduction

Studies reveal that many people around the world are poor because they live on less than \$2.15 USD per day (UNDP, 2010; World Bank 2022; World Bank, 2017, 2020; UN, 2020). Because of this, they make horrible choices for themselves and their families regarding healthcare, food, water, education, and housing. For this reason, poverty

eradication was enshrined as the first Millennium Development Goal, and also tops the Sustainable Development Goals (SDG) list that guides the post-2015 development agenda.

The foregoing calls for studies on a more regular basis to reveal the incidence of poverty in deferent parts of the world in order to properly target interventions among other things. This thinking is apt because while many countries of the world have experienced tremendous poverty reduction, the progress in Africa since the 1980s, particularly sub-Saharan Africa (where Nigeria and indeed Akwa Ibom State belongs) is slow (Chen and Ravallion, 2007).

In Akwa Ibom State, Nigeria, widespread and severe poverty is a reality. It is a reality that depicts a lack of food, clothes, education and other basic amenities. According to (NBS 2022), in the Niger Delta Region, Akwa Ibom State is the hardest hit with 5.08 million people living in multidimensional poverty. This represents over 71% of its total population of 5.451 million people estimated by the National Population Commission. This is worrisome when one considers the fact that poverty is a devil to say the least. Poverty usually has a very devastating influence on its victims. It reduces the social and psychological prestige of its victims. It is a denial of choices and opportunities, a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to; not having the land on which to grow one's food or a job to earn one's living, not having access to credit, shelter, education and health. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence, and it often implies living on marginal or fragile environments, without access to clean water or sanitation. It is the denial of choices and opportunities for living a tolerable life. They also face extreme vulnerability to ill health, economic dislocation, and natural disasters. And they are often exposed to ill treatment by institutions of the state and society and are powerless to influence key decisions affecting their lives (United Nations, 1997; World Bank 1999; Narayan 2000; Apata and Rahji, 2007; World Bank 2020; Hassan and Fatile 2023). In fact, Akwa Ibom State, Nigeria presents a paradox. The State is rich but the people are poor.

The foregoing calls for regular research and monitoring in order to determine among other things the distribution pattern of the incidence of poverty in different parts of the State. Unfortunately, the last time such a study was commissioned in the State was in 2005. The study involved a state wide household survey funded by the government of Akwa Ibom State through its life Enhancement Agency (Ekpo and Uwatt (2005). One of the problem of this study was that the resultant indexes of poverty were not mapped in order to show spatial distribution of the incidence of poverty in the area. Studies have shown that such maps are needed to among other things cost-effectively target interventions in order to eradicate or reduce the incidence of poverty in any area.

According to Ekpenyong (2008), many developing countries are confronted with widespread poverty and have limited resources for poverty alleviation. To minimize the error of inclusion and exclusion, policymakers must have accurate and detailed poverty maps that allow the identification of among other things, where the poor live, their distribution pattern, where development lags and where investments in infrastructure and

services could have the greatest impact etc. The results of estimated poverty levels could be presented in various thematic maps using geospatial techniques. This technique is an integrated approach involving remote sensing, global positioning system (GPS), and Geographic Information System (GIS). This method has been employed by several poverty mapping studies conducted in developing countries such as Ecuador (Hentschel *et al.*, 1998), Madagascar (Mistiaen, 2002), rural India (Bigman and Srinivasan, 2002), Vietnam (Minot and Baulch, 2005), Cambodia (Fujii, 2004), Morocco (Lanjouw, 2004).Unfortunately this is not the case in Akwa Ibom State, Nigeria.

The aim of this study was to analyze the incidence of poverty in Akwa Ibom State, Nigeria using geographical information systems techniques.

This was achieved through the measurement and determination of the incidence of poverty in Akwa Ibom State, and the mapping to determine and visualize the distribution pattern of the incidence of poverty in the study area

2. Materials and Methods

Location of the Study Area

Akwa Ibom State is situated in south eastern Nigeria. It lies between latitudes 4°30' and 5°30'N and longitudes 7°30' and 8°15'E (Fig.1.). It is bounded in the south by the Atlantic Ocean, in the North West by Abia State, east by Cross River State and South West by Rivers State. The State occupies a total land mass of 7245. 935 sq.km.



Fig. 1: Location of Akwa Ibom State, Nigeria Source: Akwa Ibom State Surveys, 1997.

Type and Sources of Data

Data on poverty was collected from primary source- household/questionnaire survey. This was based on the indicators/variables for measuring poverty.

Many indicators of poverty have been proposed by researchers. Based on the various definitions of poverty in literature, fifteen sets of indicators/variables were shortlisted (table 1). This comprised information in three areas reflecting the economic status, demographic/living condition and the environmental conditions of the people (World

Bank, 2017; United Nations, 2020; UNESCO, 2019; Sherin, *et,al.*, 2019; Ekpo and Uwatt, 2005).

S/N	INDICATORS/VARIABLES	SCALES OF MEASUREMENT
	Economic conditions	
1	Income	Ratio
2	Occupation	Nominal
3	Educational attainment	Nominal
4	Access to credit	Nominal
	Demographic/Living conditions	
1	Age of household head	Ratio
2	Gender of household head	Nominal
3	Household size	Nominal
4	Marital status	Nominal
5	Ethnic group	Nominal
	Environmental conditions	
1	Ownership of shelter	Nominal
2	Access to health	Nominal
3	Access to land	Nominal
4	Access to transportation	Nominal
5	Access to electricity	Nominal
6	Access to water	Nominal

 Table 1. Poverty Indicators/Variables and Scales of Measurement used in Measuring them in the Study.

These datasets were obtained from primary source (household survey) using structured questionnaire.

Population of Study, Sample Size and Sampling Techniques

The Population of study involved all residents in the 31 local government areas making up Akwa Ibom State. Multiple sampling techniques were adopted in the study.

To start with, seven Local Government Areas [LGAs] out of the 31 were selected purposively for the Household Survey. This number is more than 10% of the LGAs making up Akwa Ibom State. This number of LGAs was chosen to ensure larger sample population and coverage area. Purposive sampling technique involves selecting certain units or cases based on a specific purpose rather than randomly. According to Tashakkori and Teddlie (2003), this sampling method is to achieve representativeness or comparability. Furthermore, Singh and Masuku (2014), asserts that, one method for determining minimum sample size is by the use of sampling fraction. This is the ratio between the size of the sample and the size of its parent population. A sampling fraction of 1/10 is deemed satisfactory.

The 10% condition in statistics stipulates that when sampling without replacement, the sample size should not be more than 10% of the population. This rule helps prevent bias in statistical results, especially in studies where sampling plays a crucial role. Moreover, according to Singh and Masuku (2014), a good maximum sample size is usually around 10% of the population, as long as this does not exceed 1000. For example, in a population of 5000, 10% would be 500. In a population of 200,000, 10%

would be 20,000. This exceeds 1000, so in this case the maximum would be 1000. Therefore, in this study, areas where the 10% exceeded 1000, the 10% of the population was given as 1000.

Based on the 10% rule therefore, to identify/determine the settlements to be sampled, all the settlements in each of the seven LGAs purposively selected earlier which are shown on the Akwa Ibom State administrative map published by AKS Surveys, at a scale of 1:250,000 was numbered serially and a table of random numbers used to select 10% of the required settlements per LGA. These details are given in Table 2 and Fig. 2.

S/N	Local Government Areas Sampled in Study Area	Numbers of settlements per LGA	10% of Settlements Sampled
1	Ikono	45	5
2	Etim Ekpo	26	3
3	Uruan	36	4
4	Mkpat Enin	39	4
5	Nsit Ibom	17	2
6	Eket	22	2
7	Urue Offong Uruko	16	2
	Total	201	22

 Table 2: Sampled Local Government Areas and Sample Size (Number of settlements)

Source: Author, 2023.

Furthermore, within each of the settlements the household was the basic unit of study/research. However, since there was no settlement level population census data [based on the 2006 national population census] to rely on, the 1991 census of the settlements selected for the household survey was projected to 2023 and 10% of the population used as sample size. Household heads sampled were chosen using systematic random sampling technique.

Sampling frame used in each settlement comprised houses along only the major entrance road into the settlement. Along this major road, houses were first numbered and only houses with odd numbers were sampled (i.e. after the first house was chosen/sampled, the next one was omitted and so on). Where this arrangement did not cover the number of household to be surveyed in a particular settlement, then the streets/roads branching off from the major entrance road/street were selected using systematic sampling technique (i.e. the streets/roads were first numbered and those with odd numbers selected for further household survey until the required number was covered. In all, 9,559 household heads were involved (Table 2).

Table 3 shows the total number of questionnaire administered in the selected settlements in the State. It is obvious that, out of the 9,559 copies of the administered questionnaire, only 3976 (42%) was retrieved/returned. This low response can be attributed to a number of logistical problems.



Fig. 2: Sampled Local Government Areas and settlements in Akwa Ibom State. *Source: Author, 2023.*

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Communities Sampled	1991 Population	2023 Population	Sample Size	Questionnaire Returned	
Sampleu	i opulation	Projected	Projected	Ketuineu	%
		from 1991	Population		
Abat	1787	3931	393	113	29%
Nto Obo	1722	3788	379	19	5%
Iwukem	2125	4675	468	105	22%
Uyubia	2163	4759	476	216	45%
Udung Ukpo	627	1379	138	63	46%
Afaha Nsit	291	640	64	29	45%
Afaha Offiong	6243	13,735	*1,000	156	16%
Efoi	3436	7,559	756	344	46%
Esit Urua	2909	6,400	640	291	45%
Ikpa	331	728	73	33	45%
Idu	4056	8923	892	406	46%
Ndon Ebom	7189	15,816	*1,0	710	71%
Adiadia	38886	8,549	855	389	45%
Ikot Akpadung	551	1212	121	55	45%
Ikot Ayan Ediene	1084	2385	239	108	45%
Itak Ikot Akap	502	1104	110	47	43%
Nkaro Obio	1233	2713	271	118	44%
Ikot Ekpaw	1488	3274	327	156	48%
Ikot Ekop	2049	4508	451	172	38%
Ibiaku Esa Ekpo	1628	3582	358	167	47%
Ikot Akpaden	2239	4926	493	224	45%
Mbiafun Ikot Antia	249	548	55	55	100%
TOTAL	82,788	105,134	9,559	3,976	42%

Table 3: Total Number of Questionnaire Administered

<u>N.B</u>:* Cases where 10% of population exceeded the maximum 1000 rule.

Methods of Data Analysis

Measurement and determination of incidence of Poverty

One central issue in the study of poverty is having a measure of the standard of living and choosing a level which separates the poor from the non-poor. This level of standard of living is called the poverty line. Poverty line is the minimum amount of money a person needs, to fulfill the basic necessities of life like shelter, basic food, clothing etc. Several methods have been suggested for the measure of standard of living and poverty line. Of all these, the income/expenditure benchmark and the minimum calorie requirements are the most commonly used criteria (Ravallion, 1992; World Bank, 2000; Ekpo and Uwatt, 2005).

Levy (1991) asserted that to measure poverty, two tasks should be accomplished: (i) a poverty line for the poor must be determined and (ii) the poverty level of individuals has to be aggregated. As put forward by Anyanwu (1997), the poverty line is the minimum or the cut off standard of expenditure on food or per capita income below which an individual or household is described as poor. In this study therefore, the international poverty line was adopted.

In September 2022, the international poverty line was updated from \$1.90 to \$2.15 by the World Bank (World Bank 2022). This poverty line was adopted in this study because while the global rate may not be dramatically different after adoption some regional and country rates may fluctuate considerably. Based on the exchange rate of N1012.62 to a dollar (CBN 2023) as at December 2023 when the household survey questionnaire was processed, the poverty line was determined as N65, 313.19 per person per month which was above the national minimum wage of N30, 000.00.

Having determined the poverty line, the next step was to carry out poverty analysis decomposed into various indexes. According to Ekpo and Uwatt 2005, the most frequently used measurements are the following:

a. The first measure is the Headcount Index of Poverty, given by the proportion of the population for whom total per-capita household consumption (income) y is less than the poverty line z. It is the most popular poverty measure. The main advantage is its simplicity. If q is the number of poor people in the population of size n, then the Headcount is given by:

$$P0 = \frac{q}{n}.$$

Where q is the number of poor people (those whose income or consumption fell below poverty line) and n is the total number of people, poor or not, in the group within which the poverty rate is being calculated (Foster *et al.*, 1984).

The measure/computation is usually in percentage. This means that values below 50% indicate low poverty incidence/gap/severity and values 50% and above indicate high poverty incidence/gap/severity. However, the disadvantage of the headcount measure is that it is insensitive to differences in the depth of poverty.

b. A way to consider the poverty deficit of the poor relative to the poverty line is to use the Poverty Gap Index. Let Q be the sub-group of poor, the poverty gap is then given by:

$$P1 = \frac{1}{n} \sum_{i \in \mathcal{Q}} \frac{(z_i - y_i)}{z_i}.$$

Where y_i = income of individual (the sum is taken only on the poor) and z = poverty line; n = population size (Foster *et al.*, 1984).

Poverty gap allows an interpretation in terms of the potential fiscal cost for eliminating poverty by targeting transfers to the poor. Summing all the poverty gaps in the sample population and taking the average provides an estimate of the minimum cost of eliminating poverty in the society, assuming perfect targeting.

c. One limitation of the poverty gap measure is that it does not capture differences in the severity of poverty adequately. This calls for the inclusion of the Severity of Poverty Index in the poverty analysis. This measure gives more weight to the consumption (income) gap of those households located further below the poverty line and is defined as:

$$P2 = \frac{1}{n} \sum_{i \in Q} \frac{(z_i - y_i)^2}{z_i^2}.$$

The severity index has the advantage for comparing policies which are aiming to reach the poorest, but it is more difficult to interpret and is less intuitive than the two previous poverty measures (Foster *et al.*, 1984). All 3 measures were computed using information on the income of respondents from the administered questionnaire.

Mapping of the incidence of poverty

Within the GIS environment, attribute data on incidence, depth and severity of poverty (i.e computations based on the indices of poverty listed above for each of the settlements sampled) was imputed, stored and manipulated to produce poverty maps using the surface mapping technique. Associated with surface mapping technique is interpolation. Interpolation is a process of using points with known values to estimate values at other points. The basic principle is the assumption that the value to be estimated at a point is more influenced by nearby control points (points with known value) than those that are farther away. One of the advantages of the surface mapping technique is that, since not all the households in an area are sampled, the interpolation scheme used can take care of data poor areas created as a result of sampling households in few settlements (Kraak and Ormeling, 1996; Robinson *et al.*, 1995).

Interpolation schemes can be grouped as deterministic (non stochastic) or statistic (stochastic). Unlike the statistical interpolation scheme, the spatial correlation properties within the dataset are not taken into account in the deterministic scheme. The distances are considered as geometric distances, not in a statistical sense. Most datasets required for poverty mapping are of stochastic nature because they contain a structural element and a random component (Chang, 2000).

The deterministic scheme attempts to fit a type of surface through a set of sampled z values at known x,y coordinates. If the data points are true values of the variable, at the sampled locations, an exact scheme is required. A smoothing/filtering scheme may be selected if there is considerable measuring error and/or when one decides to ignore random spatial variation in the sample set (Chang, 2000).

The statistical schemes depend on whether or not the spatial dataset may be considered as having random variation. If not, the estimation of z may be done in terms of probability. Furthermore, an interpolation scheme which takes into account all reference/data points is termed a global scheme, in contrast to the local schemes which uses a local area, known as neighborhood or window. The windows are shifted over the entire data set stepwise to complete the interpolation. It is obvious from the foregoing that, the choice of any interpolation scheme depends on the nature of the variable and its associated spatial variation, although there are other influences (Meijerink *et.al.*, 1994; Burrough *et.al.*, 1998; Chang, 2000).

In this study, the inverse distance weighted (IDW) interpolation scheme was used. It is a local method that assumes that the unknown value of a point is influenced more by nearby control points than those further away (Chang, 2000). The IDW interpolation scheme is more appropriate because studies have shown that settlements that are close together have more homogeneous socio-economic characteristics and the population is subject to the same agro-climatic and geographic conditions (Bigman *et.al.*, 2000).

Determination of the Distribution pattern of the incident of poverty

To analyze the pattern of distribution of the incidence of poverty in the study area, spatial autocorrelation (Moran's I) was used to test hypothesis 1. Spatial autocorrelation is a method that can be used in detecting spatial patterns of point distribution by considering both the locations of the points/areas and their attributes [in this case, poverty incidence]. Spatial autocorrelation of a set of points/ areas is therefore concerned with the degree to which points or things happening at these points/ areas are similar to other points or phenomenon happening there. This makes it possible to determine whether the pattern of distribution is clustered, dispersed or random (Getis and Ord, 1992; Mitchell, 2005).

3. Results and Discussion

Demographic and Socio-economic characteristics of Respondents

Table 4 presents the demographic and socio-economic characteristics of the respondents. Most of the respondents [79%] were males and most of them [56%] were between ages of 26-50 as shown in table 4.2. Most of the respondents [71%] were married as shown in the table above. Also, most of them [31%] had secondary education. Moreover, most of them [31%] were farmers. Also, most of them [36%] earned income of between N31, 000 to N100, 000.00.

	CHARACTERISTICS	NO OF	% OF
		RESPONDENTS	RESPONDENTS
1	Gender of House Hold heads		
	Female	1537	39
	Male	2439	61
2	Age Distribution of Respondents		
	<25	905	23
	36-50	2229	56
	51-100	842	21
	>100	0	0
3	Marital Status		
	Single	586	15
	Married	2819	71
	Widow	468	12
	widower	103	3
4	Level of Education		
	Non formal	822	21
	Primary	1009	25
	Secondary	1237	31
	Tertiary	908	23
5	Occupation		
	Trader	954	24
	Farmer	1232	31
	Civil Servant	940	24
	Others	850	21

 Table 4: Demographic and Socio-economic characteristics of Respondents in 2023

6	Level of Income[Naira]		
	<30,000	1193	30
	31,000-100,000	1436	36
	>100,000	735	18
	Not Known/Specified	612	15
7	Other socio-economic	Number of Respondents	Percentage [%] of
	characteristics	without access [out of a	Respondents
		total of 3976]	without access
	Access to health care	2547	64
	Access to shelter/housing	2837	71
	Access to electricity	2289	58
	Access to portable water	2489	63
	Access to land	2989	75
	Access to transportation	1987	50
	Access to Capital	2765	70

Source: Result of household/questionnaire survey by author 2023

Furthermore, as shown in Table 4, most of the respondents did not have access to basic needs like health, housing, electricity, water, land, transportation and capital. With these characteristics, the incidence of poverty in the area should be high and wide spread.

Incidence of Poverty in Akwa Ibom State

Table 5 shows details of settlements sampled and their measures of poverty (i.e. headcount index, poverty gap index and severity index). It's obvious from table 4 that most residents in the settlements sampled were poor. The proportion of those that were poor was high (i.e. headcount index of 50% and above) in 8 out of 22 settlements and moderately poor (i.e. headcount index of between 40% and 49%) in 11 out of the 22 settlements. Only 3 settlements had headcount index of below 40%. In other words, the population/proportion of the poor was high in 8 settlements, moderate in 11 settlements and low in 3 of the settlements. Furthermore, table 5 and Fig. 3 also shows that, the gap/depth/intensity of poverty [poverty gap index] and inequality among the poor [poverty severity index] in the area was low (i.e. below 50%) in all the settlements sampled.

Local Government	Settlements	Head Count	Poverty Gap	Poverty Severity
Areas	Sampled	Index[%]	Index[%]	Index[%]
ETIM EKPO				
1	Nto Obo	47	19	11
2	Abat	55	24	14
3	Iwukem	46	22	14
URUE OFFONG				
4	Oyubia	51	22	12
5	Udung Ukpo	59	30	19
NSIT IBOM				

Table 5: Estimate of the incidence of Poverty in sampled settlements in Akwa Ibom State.

	6	Afaha Offiong	40	19	11
	7	Afaha Nsit	26	12	6
URUAN					
	8	Ikpa	58	30	19
	9	Idu	45	22	13
1	0	Ndon Ebom	53	26	16
1	1	Adiadia	45	22	13
EKET					
12	2	Effoi	42	23	14
1	3	Esit Urua	46	22	15
MKPAT ENIN					
1-	4	Ikot Ekpaw	48	22	13
1	5	Ikot Akpaden	36	19	12
1	6	Ibiaku Esa Ekpo	35	16	10
1	7	Ikot Ekop	47	22	13
IKONO		-			
1	8	Itak Ikot Akap	47	21	13
1	9	Mbiafun Ikot Antia	44	23	14
2	20	Ikot Akpadung	51	20	11
2	21	Nkara Obio	55	31	20
2	22	Ikot Ayan Ediene	67	42	28

Source: Computation from field data by Author (2024); <u>NB</u>: The measures/computations are usually in percentage. Values below 50% indicate moderate or low poverty incidence/gap/severity and values above 50% indicate high poverty incidence/gap/severity.



Fig. 3. Group Bar Graph showing Incidence of Poverty in Akwa Ibom State Source: Table 5

Mapping to Reveal the Distribution Pattern of Incidence of Poverty in Akwa Ibom State

As stated earlier, data on head count index in table 4 was used to create the map in a GIS environment (Fig. 4). The map Fig. 4 shows the pattern of distribution of the incidence of poverty as at 2023 when the household survey was conducted.



Fig.4. Akwa Ibom State: Poverty Incidence [Headcount Index]. Source of data: Table 5: Column on Headcount Index

It is obvious from the map that, the proportion of poor people was high in locations in the northern, western and Eastern parts of the state (i.e parts of Ikono, Ikot Ekpene, Essien Udim, Abak, Etim Ekpo, Ukanafun, Oruk Anam, Ibiono Ibom, Itu, Uruan, Okobo, Urue Offong Uruko, Udung Uko, Mbo and Esit Eket), moderate in the northern, south eastern and western part of the state (i.e. Oron, Obot Akara, Ika and parts of Ini,

Ikot Ekpene, Ikono, Etim Ekpo, Essien Udim, Ukanafun, Oruk Anam, Mkpat Enin, Etinan, Eket, Ibeno, Mbo, Udung Uko, Esit Eket, Nsit Atai, Okobo, Uyo, Itu, Ibiono Ibom, Uruan, and Ibesikpo Asutan) and low in the central and south west parts of the state (i.e. Nsit Ibom, Onna, Eastern Obolo, Ikot Abasi and parts of Eket, Ibeno, Esit Eket, Nsit Ubium, Nsit Atai, Ibeskpo Asutan, Uyo, Etinan, Abak Mkpat Enin, Oruk Anam, Ini, Ikono and Uruan).

Testing of Hypothesis 1

 $H_{\text{o}}\text{:}$ The distribution pattern of the incidence of poverty in Akwa Ibom State is not significantly clustered.

Results from the spatial auto correlation analysis are as follows:

Spatial Autocorrelation Report



Global Moran's I Summary

Given the z score	af 0 025666884472	the nattern	is significantly	v random
Orven the 2-score	010.923000004472,	the pattern	is significanti	y random.

Moran's Index:	0.170440
Expected Index:	-0.047619
Variance:	0.055493
z-score:	0.925667
p-value:	0.354619

Given the Z score of 0.925667, the distribution pattern was significantly random. In other words, the pattern exhibited by the incidence of poverty in the study area is random. In view of the foregoing, the null hypothesis that, the distribution pattern of the incidence of poverty in Akwa Ibom State is not significantly clustered was is accepted. Random pattern implies that the incidence of poverty in the area was not planned or as a result of people living together because of something they have in common. It occurred by chance mainly because of deprivation of basic human needs.

This study has resulted in a map that shows the distribution of the incidence of poverty in different parts of the State. The map shows areas where poverty was high, moderate and low (Fig.4). However, the headcount ratio, alone, is not sufficient in determining how populations fare compared with the rest of the population living above the poverty line. Measuring the poverty gap (how far below the poverty line a person or a household is – also known as depth of poverty) captures the average shortfall in income of the population living below the poverty line. The sum of these poverty gaps gives the minimum cost of eliminating poverty. Moreover, since the measure does not reflect changes in inequality among the poor, the squared poverty gap index, also known as the poverty severity index gives an indication of inequality among the population living below the poverty line (Foster-Greer-Thorbecke 1984; Ekpo and Uwatt 2005; Apata and Rahji, 2007). Although the level of poverty in the study area was significant, the good news is that the poverty gap and severity index swere generally low (i.e. below 50%) in the entire study area during the period under review (Table 5 and Fig. 3).

Low poverty gap index indicates that poverty was not intense in the study area. It means that the difference between the poverty line and the income of respondents was low and that the cost of eliminating poverty was also low in the study area. Also, low poverty severity index means low level of inequality between the poor because of a number of factors including the different levels of educational attainment, difference in the types of occupation people were engaged in etc. The implication of the foregoing is that what it will cost to bring people at least up to the poverty line in the study area is low, so also is the inequality between the poor in the area.

Furthermore, the distribution pattern of the incidence of poverty in the area was found to be random. The distribution pattern refers to the way in which physical or cultural phenomena are spread out or arranged across space. Individuals may be distributed in a uniform, random, or clumped pattern. Uniform means that the population is evenly spaced, random indicates random spacing, and clumped means that the population is distributed in clusters. As stated earlier, this random distribution pattern implies that the incidence of poverty in the area was not planned or as a result of people living together because of something they have in common. It occurred by chance mainly because of deprivation of basic human needs. According to Molles, (2008), a truly random distribution is uncommon in nature since organisms tend to interact with both their environment and nearby organisms. Random distribution usually occurs in habitats

where environmental conditions and resources are consistent. This pattern of dispersion is characterized by the lack of any strong social interactions between species.

In view of the foregoing, this study has established the fact that as at the year 2023, poverty was randomly distributed in the study area. These findings are not unique to the study area only. A number of studies elsewhere in the world have revealed similar findings (Khan *et. al.* 2003).

4. Conclusion and Recommendations

This study produced a map that have made it possible for the distribution pattern of the incidence of poverty to be discerned or visualized. This makes targeting the poor for any poverty eradication programme very easy and cost-effective. With such a map and the GIS technology, it is possible to among other things determine precisely where the poor are concentrated, what natural resources are available for use to alleviate poverty, the state/conditions of infrastructure in such locations to mention just a few. This could in turn help the policy makers and all other stakeholders in combating this fundamental threat to well-being. Identifying where the poor are at a particular point in time is a gap in knowledge that must be consistently closed for us to make significant progress in poverty alleviation/eradication/reduction.

Based on the findings of this study, the following recommendations are suggested in order to eradicate/reduce the incidence of poverty in the study area:

- 1. Incidence of Poverty is dynamic in nature. Someone who is poor today can become rich overnight because of socio-economic changes that may suddenly occur in life. This underscores the need for regular household surveys and mapping by relevant authorities/agencies to ensure that interventions are based on well informed decisions and not political considerations.
- 2. In line with the Millennium Development Goals (MDGs) of the United Nations (UN), poverty reducing efforts in developing countries must be based on adequate knowledge of who the poor are, where they dwell, their source of income, and production activities, if any tangible result is to be achieved. This research resulted in maps that can be used to determine who the poor are, where they dwell, their source of income, the natural resources at their disposal and production activities among other things.

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