GSDI-9 Conference Proceedings, 6-10 November 2006, Santiago, Chile

Developing Geospatial Information for Poverty Reduction: Lessons and Challenges from Nigeria's 2006 Census.

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Abstract
There is a misconception in what constitutes infrastructures not only in Nigeria but in most developing world. Infrastructures which were hitherto viewed as physical facilities can now be conceptualized as geo-spatial information. Since information regarding poverty is scanty in Nigeria, alleviating sufferings is thus a problem where the proportion of the poor is on the increase. Ogwumike (2001) summarized the trend and reported it as being 27% in 1980, 46% in 1986, 67% in 1997 and 70% in 1999. Similarly, recent studies of poverty in Nigeria show that poverty is widespread (Adeyeye and Nwosu, 1998, World Bank, 1996). It is also estimated that over half of the population are living in poverty (World Bank, 1996). This is in spite of the fact that Nigeria is endowed with an array of natural resources that adorn the layout of the ecological zones from the south to the northern part of the country. Similarly, exploration and exploitation of different minerals resources in the country also put the nation in the forefront of countries that is rich but whose citizens still live in poverty. This study is carried out with the aim of identifying poverty related information from year 2006 census and determines how they can be used to build geospatial information for poverty reduction. The basic question set utilized in this paper was collected from year 2006 Census questionnaire NPC Form 01 to create and determine NPC file structure which could be used to determine the pattern of poverty level in the country. The NPC file structure is then used to store and retrieve information about the pattern of poverty in the country as well as facilitate recommended solutions directly to the Local Government Areas (LGAs). Results include the facilitation of data collection through widely available, accessible, current and reliable source as provided by census with little or no additional cost. Challenges include exploiting of a single source (census) of geo-information to reduce wastage. It is therefore recommended that questions that could evoke desired response on the pattern and size of poverty levels of Nigerians be entrenched in our future censuses. Gathering information through census however is not enough but using such information to improve the standard of living of people is equally important and should be encouraged by any Government in power.

Key words: Nigeria, geo-spatial information, poverty, census, wetland, and militant groups.

Introduction:
Generally speaking, past Governments in Nigeria have concentrated efforts at the development of physical infrastructures such as roads, electricity, portable water supply, hospitals, schools and shelters as means of raising the standard of living of their people at the expense of data infrastructure. Before elections are held, politicians use some of the infrastructures so mentioned above to canvass for votes from their constituencies. At the end of such elections, people's expectation of the Government in power is to see them fulfilling their electoral promises. Along the line too, some people believed that the government has fulfilled its electoral promises, once some of these infrastructures are put in place irrespective of people's accessibility to them.

Today, people are not only becoming conscious and more enlightened on what constitute infrastructures but they now know that infrastructures go beyond mere physical infrastructures. This is why information or data acquisition in its right proportions in terms of spread, intensity, location and time is the most important geo-spatial infrastructures that any Government can boast of. A country with this type of infrastructures can plan within the limit of its resources to achieve the desired goals set for its citizenry and put smiles on them.

Political instability has been noted to be a factor that makes a nation to be poor. People become skeptical in terms of whether to invest their money or not in any government unless they are certain of its stability. For a very long time, and in particular, between 1966 and 1999, coups d'etat characterize the political terrain of Nigeria. In addition to this, there was violence of different magnitude at the regional level which makes investment in business risky.

Similarly, the quality of leadership is an important factor in the determination of poverty eradication of a nation. Nigeria is a country that is rich ecologically in terms of natural vegetation and mineral resources but is in "want" in the mist of these abundant resources. This has been partly attributed to the inability of some of our leaders to harness the abundant resources for the good of the masses.

Statement of problems
There is a misconception in what constitutes infrastructures not only in Nigeria but in most developing world. As pointed earlier, infrastructures are limited to facilities such as road network, housing structures, portable water supply, hospitals, schools and the likes. But with the development in information telecommunication, the awareness is gradually being created to inform people that provision of geospatial information is an important infrastructure that influences the impact of other conventional infrastructures in any country.

For a very long time, the dearth of data in terms of coverage, intensity and reliability constitutes one of the major problems inhibiting development plans in developing countries. Most of the development plans are hinged on inaccurate information on the population structures. Thus, the developmental efforts fail to achieve the desired results because policy makers plan without accurate data or information.

Information regarding poverty in Nigeria is scanty and largely restricted by the means by which they are collected. In Nigeria, Federal Office of Statistics (FOS) are saddled with the responsibilities of collecting vital statistics of the social, political and economic attributes of the people, corporate bodies and government institutions. The data collected by this arm of government is limited by the method adopted in the collection of the vital Statistics as well as the commitment of the field officers. By and large, information collected by the FOS is not comprehensive and as such can be described as under estimation of the picture of what the reality portrays.

It is in the light of these shortcomings, that this study is carried out with the aim of developing geospatial information for poverty reduction in Nigeria. To achieve this aim, the study identifies poverty related information from year 2006 census and determines how they can be used to build geospatial information for poverty reduction. The paper also discusses how to develop a geospatial information system that will not only automate data storage, retrieval and facilitate solutions to poverty issues but show the pattern of the problem in the country.

Conceptual issues and relevant literature

A national infrastructure may be described as a collection of facilities, services and equipment serving a particular country as a whole. Such infrastructure may include factories, roads, electricity, schools, etc. and forms an integral part of an entire national system designed to serve the community as a whole and without which it is likely to fall into difficulties or chaos (Akingbade, 2004). The concept of geo-spatial data as infrastructure is therefore a recent phenomenon. This is in spite the fact that it forms the bedrock for planning and developing other physical infrastructures of the nation.

Today, it has been realized that, spatial data or geo-information (GI) is essential input in the provision of social amenities to people of a nation. Thus, for equitable distribution of job opportunities, energy, water, health facilities and schools, GI is essential infrastructure that provides the bedrock for effective and efficient planning for growth and development. According to Akingbade (2004), the primary focus of GI is the facilitation and coordination of exchange and sharing of spatial data between GI stakeholders at different levels: global, national, state and community.

Poverty is a multidimensional problem that can be viewed from economic, social and environmental perspective. It can also be viewed from relative and absolute perspectives which suggest that poverty varies with respect to types and intensity. This means that poverty shows a kind of pattern which can be studied using GIS. Although there is no consensus on the definition of poverty but can be defined as lack of basic necessities that all human beings must have: food, portable water, shelter, education, medical care, electricity, etc. Any human being that cannot afford the aforementioned necessities of life in a reasonable proportion can be said to be poor. In most cases therefore, poverty are caused and as such can be regarded as a form of oppression. Some of the causes of poverty include corruption, political instability, bad leadership and oppression of man by man. According to Salawu et al (2004), the Natural Circumstances Theorist believes that poverty is basically the outcome of self-perpetuating cultural and social deficiencies,

which are beyond the capacity of individuals to remedy through their own efforts. The theory, therefore, suggests that the government has a very important role to play in alleviating poverty through its policy instrument.

Poverty is a phenomenon that results from various factors at play. In Nigeria, corruption has been noted to contribute to poverty. Political leaders with access to the national treasure convert the public funds to their private uses. According to Ekiyor (2005), cases of government funds that were set aside for the development of the nation and looted to private accounts abroad are common phenomenon not only in Nigeria but also in most of the developing countries. This type of behavior has contributed in no small measure to the problem of poverty in Nigeria and other developing worlds.

The plight of the poor is better imagined than experienced in Nigeria where the proportion of the poor is on the increase on daily basis. Ogwumike (2001) summarized the trend and reported it as being 27% in 1980, 46% in 1986, 67% in 1997 and 70% in 1999. Similarly, recent studies of poverty in Nigeria show that poverty is widespread (Adeyeye and Nwosu, 1998, World Bank, 1996). It is also estimated that over half of the population are living in poverty (World Bank, 1996). This is in spite of the fact that Nigeria is endowed with an array of natural resources judging by the layout of the ecological zones from the south to the northern part of the country. Similarly, exploration and exploitation of different minerals resources in the country also put the nation in the forefront of countries that is rich. Yet, the people from the oil rich environment live in abject poverty.

It is however saddening to note that in spite of the aforementioned scenario, corruption and poverty in its relative and absolute forms exist in both the rural and urban centers of Nigeria and it is in its highest ebb. The irony of the situation is that Nigeria sits on abundance of natural resources and is rated to be the 6^{th} oil producing country in the world. In spite this opportunities, Poverty in its entirety manifest in form of low per capita income, malnutrition, poor health, torn cloths, poor shelter, poor formal education and unbalanced diet. According to Ekiyor (2004), Transparency International described Nigeria as the third most corrupt in the world and that the country competes for poverty with some of the poorest countries in the world. The country, according to him, now occupies 154^{th} position in a total of 172 countries in the world marginal index on poverty. This picture of Nigeria is most unfortunate in view of the abundance of natural resources that adorn the length and breadth of the country.

Another dimension of poverty is absolute and relative poverty. Absolute poverty refers to subsistence living below minimum, socially acceptable living conditions usually established based on nutritional requirements and other essential goods such as enough food to eat, clothes to wear and shelter. The international development target for economic well being is to reduce by half the number of people living in absolute poverty by 2015. In setting this target, according to (Gasu, 2006), the equivalent of one US dollar a day has been adopted as the measure of absolute poverty. On the other hand, relative poverty compares the lowest segment of the population with upper segments. It looks at poverty in relation to commonly agreed needs for a descent standard of living in a

particular society. Relative poverty therefore takes into account other things besides the basic needs for survival.

The reduction of poverty in developing world, where on the average, majority of the population is considered poor, has become Herculean task. According to Salawu (2004) poverty can be conceptualized in four ways; lack of access to basic needs/goods; a result of lack of or impaired access to productive resources; outcome of inefficient use of common resources; and result of exclusion mechanism on some people. In addition to this, some people who are accessible to wetlands, and who actually make a living from this rich environment still exhibit poverty. These categories of people are largely migrant workers/labors that have refused to quit poverty as a way of life.

Attempts have been made through commissioned studies, non-commissioned studies, Non-Governmental Organizations, policy makers and militant groups to show the whole world that there is no other developmental issue that poses a fundamental major challenge to Nigeria today than the issue of poverty. There are violent outburst by militant groups in the riverine areas of Niger Delta to protest pollution of land, water and air of their environment by oil mining companies. This type of pollution has contributed immensely to the impoverishment of the people of the region because their means of livelihood are cut off. However, government has put in place some measures to alleviate the sufferings of the poor. This probably accounted for why poverty alleviation programme took a prominent place in successive government activities in Nigeria. It is pertinent, to note that, despite the propaganda and orchestration that go along with the poverty alleviation programme, not much has been realized in terms of unemployment reduction. Thus, the reality is that poverty is all pervading in the country because the government does not have accurate idea of the population that is poor, their level of poverty, their spatial location and most importantly how to get across to these categories of the poor what could alleviate their poverty.

Brief about the study area

The study area is Nigeria and is located within the sub-region of West Africa in Africa. The country is bounded in the north by Niger, in the east by Chad and Cameroon, in the south by the Gulf of Guinea, and in the west by Benin Republic. Nigeria is the most populous country in Africa and has an extensive area extent of 923,768 sq km that span through forest and savanna vegetation found in the ecological zone of West Africa.

Nigeria has a long history of census which dates to 1866 (first census). This was followed by 1871 and 1896 (though restricted to Lagos Island and Mainland). Censuses of 1901, 1911 and 1921 covered in addition to Lagos, a few more urban towns in the colony (Census, 2006). Censuses of 1952/53, 1962/63, 1973, 1991 and 2006 covered the whole country. The censuses have their limitations in terms accuracies and acceptability but they remain the only method of getting the official figure for the country.

The questions in the past censuses were restricted to the population of the nation except that of the 2006 which in addition to the population of the nation also covers housing census. Thus, questions which border on the standard of living of the people were

included in the 2006 population and housing census of Nigeria. This is a departure from the former pattern and critically examined is capable of providing information about the distribution of poverty in the country.

Methodology

The basic question set and the filing structure utilized in this paper were collected from year 2006 Population and Housing Census questionnaire NPC Form 01. The questions that were relevant to this study and which were included in the 2006 population and housing census are sex, age, place of usual residence, literacy level, educational attainment, marital status, work status, occupation, class of work, type of living house, tenancy arrangement, household lighting fuel, type of housing unit and sleeping room arrangement. Other questions which could be added at no cost to information collection on poverty but which were not used in the census exercise include access to portable water supply, housing facilities in good conditions, access to medical facilities, access to primary and secondary education, etc.

The six geo-political zones into which the country is divided are used as the sampling frame on which the database management is built as shown in Table 1. This is followed by the States and then the number of Local Government Areas (LGAs) in each geo-political zone. This structure is used to create and determine NPC file structure which could be used to determine the pattern of poverty level in the country as well as proffer means of reducing the problems. The LGA is the smallest political unit in the country (often regarded as the grass root government) where government policies can easily be passed to the people of the country. The NPC file structure is therefore created to store and retrieve information about the pattern of poverty in the country as well as facilitate recommended solutions directly to the LGAs

GEOPOLITICAL ZONES	STATES AND FCT	LOCAL GOVERNMENT AREA	SUPER - VISORY AREA	ENUMERA - TION AREA	LOCALITY	BUILDING	HOUSE - HOLD
NORTHERN MINORITIES ZONE	7 States	186 LGAs					
NORTH EAST ZONE	6 States	112 LGAs					
NORTH WEST ZONE	7 States & FCT	121 LGAs					
SOUTH EAST ZONE	6 States	137 LGAs					
SOUTH SOUTH ZONE	6 States	125 LGAs					
SOUTH WEST ZONE	5 States	93 LGAs					

Table 1: Sampling Frame for Database Creation for Poverty Identification

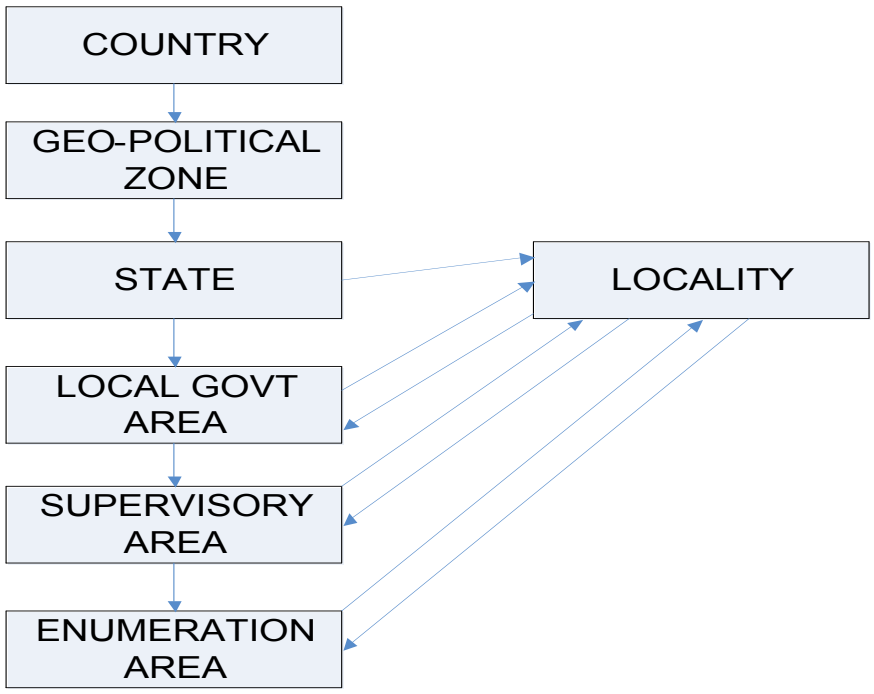

Figure 1: NPC File Structure

The NPC file structure is shown in Figure 1 where a file is created for the map of the country and regarded as the country file. This is followed by the six geo-political zone file, then State files and LGA file which is largely drawn on supervisory and enumeration area as the smallest unit in the conduct of Census. With this file structure, it becomes easy to determine poverty structure and their level of intensity in the country as well as use it to proffer solutions.

Creation of Database for Poverty Reduction

The view of reality relevant to database creation for poverty alleviation as drawn from 2006 NPC for Nigeria is in two forms. The first one is the entities which are stated in Table 1 and the second one is the attributes of poverty which are stated in the questionnaire as reflected in NPC Form 1 and depicted in Figure 2.

In Nigeria the NPC has the structure of its own data set through which the2006 Census was collected. In the development of Geospatial information for poverty reduction, census data for 2006 as recorded by NPC can be transferred into a database management using the filing system as shown in Figure 1. This filing system in ascending order starts from the distinct household to individual buildings, locality, Enumeration areas (EAs),

Supervisory areas (SAs), Local Government Areas (LGAs), States, Geo-political Zones and the country. The details of the entities and their description are as shown in Table 2.

Table 2: Census entities and their description

s/no	Entities	View of reality
1	Household	A person or group of persons living together usually under the same roof or in the same building/compound, who share the same source of food and recognize themselves as a social unit with a head of household. They may or may not be related by blood.
2	Building	Is an independent freestanding structure with an independent entrance and with one or more rooms where a person or more live.
3	Locality	This is a distinct inhabited place in which the inhabitants live in neighboring building and which has a name or a locally recognized status.
4	Enumeration area	A compact area carved out of a locality or made up of a group of localities with well developed boundaries.
5	Supervisory area	An area made up of two or five contiguous EAs
6	Local Govt. Area	An administrative area consisting of localities
7	State	An administrative area consisting of LGAs
8	Geo-political zone	An administrative area consisting of about 5 or 6 States of the Federation which are contiguous and closely located

Figure 2 shows the entity relationship diagram for poverty identification in the country. With this diagram, it becomes easier for poverty to be examined and determined at the lowest level of household, traced through locality to the highest level which is the country. The linkage of many to one shows the relationship that exists between an entity and the other. For example, many localities exist in an enumeration area; many EAs in one supervisory area, many SAs in a LGA, etc. With this arrangement, it becomes easier to determine within a given criteria, the population of people that are poor or people that are living below certain condition of living. This is because a significant amount of data acquired by the National Population Commission (NPC) can serve many applications. In the past, the NPC conduct census exercise that were restricted to counting the number of people and their demographic attributes while in 2006, it has been elaborated to accommodate housing population. Since some of the questions that were used in the 2006 census are related to poverty, others that are absent could still be identified and built into it. With this type of comprehensive information on poverty, one can determine relative and absolute poverty of each State, LGAs, Supervisory area and enumeration area using the primary data collected from the census.

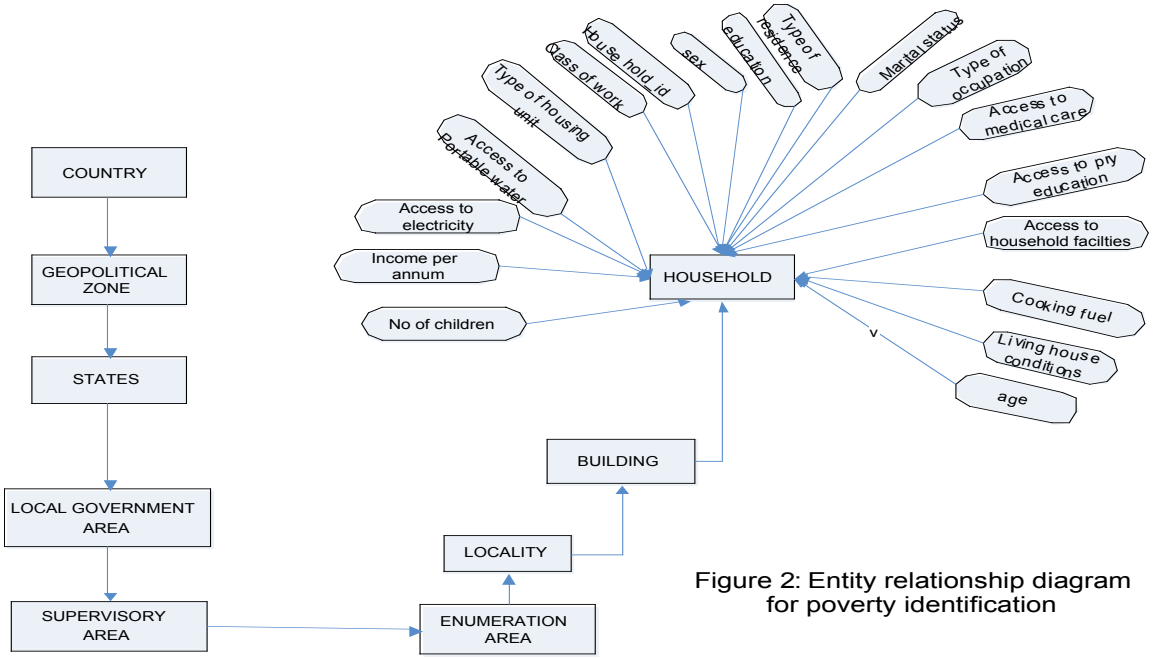

Figure 2: Entity relationship diagram for poverty identification

The identification of the entity relationship from the 2006 census is followed by transformation of the conceptual model into the logical model form. Here Tables are created for each of the entities identified and populated. Thus in this study six geopolitical Tables are created with their primary identification numbers, the same is done to the States with their primary identification numbers down to the LGAs, SAs, EAs, localities, building and household levels as shown in Table 1. The next thing is to populate each table using the identified attribute for poverty determination in the country. The unique identification code attached to each entity makes it possible to link the attribute table (poverty) to the geographical space where they occur. The attribute in the designed relational structure is mapped into the data type of the chosen relational database management system (RDBMS).

Discussion

Information relating to poverty was identified in the 2006 census in the country and can be entered for each household, building, locality, EA, SA, LGA, State and Geopolitical zones in the country. The entity tables once populated in line with the structure shown in Table 1 provide a comprehensive means of determining poverty distribution in the country. This database can be linked to the map of Nigeria which of course can be subjected to different types of analysis once it is geo-referenced and encoded in a GIS environment. Thus, the map could be queried at various levels to provide poverty information on a State or LGA or SA or EA or Locality or household level. For example,

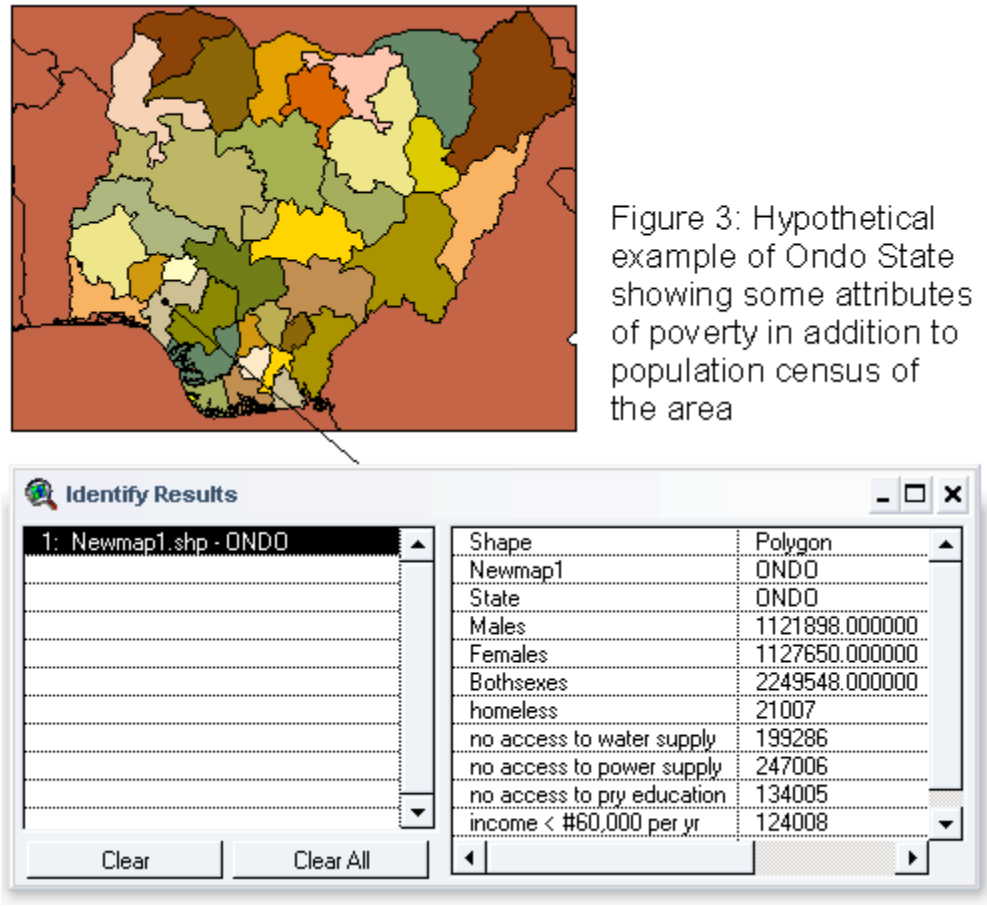

Figure 3: Hypothetical example of Ondo State showing some attributes of poverty in addition to population census of the area

The database is capable of providing information on the problem phenomenon as well as providing response to queries on population of the people in different LGA with no jobs, salaries below #60,000 per annum, people that have no access to portable water supply, people that have no access to medical facilities within a trekking distance of 5 kilometers etc.

Census information is gathered once in every ten years in Nigeria and is capable of making planning more focused if well utilized and implemented. Policy makers can use such information to produce maps that will show people that are homeless, that have no access to portable water, that have no access to basic health services, that have no access to primary education, etc in any environment using the minimum standard as set by United Nations.

Database created from census source can also provide a means of determining army of jobless but able bodied young people in the country. Thus, with information on the ecological zones of the country and the knowledge of information base of the nation's mineral resources, it becomes easier for policy makers to identify any part of the country

from where to draw human resources (jobless people) to work on any job that might be created in such area using the available data on natural resource endowment of such zone.

The database created is also capable of providing response to queries raised on poverty. For example the map can be queried to provide answers on people that are homeless as shown in Figure 4, those that have no access to portable water supply, and those that have no access to electricity, etc

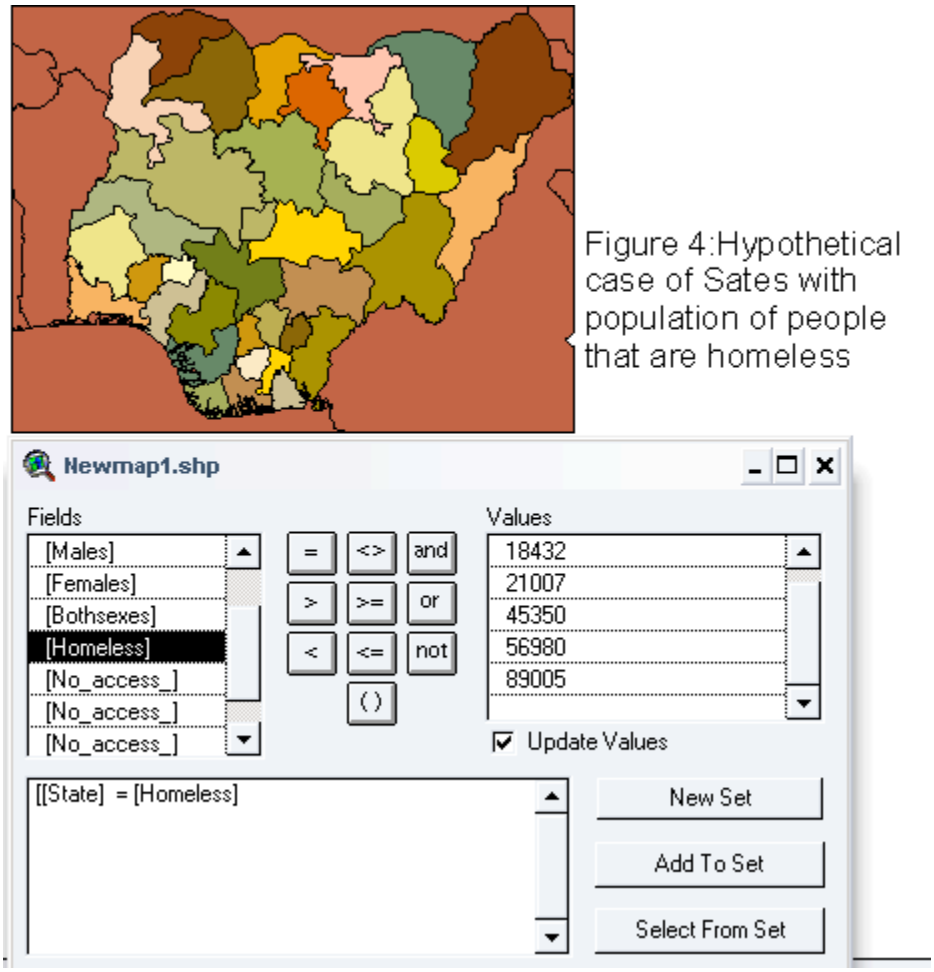

Figure 4:Hypothetical case of Sates with population of people that are homeless

Nigeria is well blessed in terms of natural resources. The forest vegetation adorned the southern part of the country while the savanna occupies the northern part. Thus, the country is capable of producing root crops from the south and cereals from the north. The Inland water ways which adorn all parts of the country also provide opportunities to practice wetland agriculture throughout the year where they are so located. The identification of poverty level in terms of age, education, population etc can be used by Government to provide enabling environment in terms of agricultural activities for people under such conditions to make them gainfully engaged in primary activities that would raise the standard of living.

Natural resources that are yet to be tapped are found in different localities in the country but because the people are poor, they need to be assisted by Government before they can be gainfully tapped. In such situations, information regarding this category of people can be known and used to provide bases for the establishment of industries in such area.

Lessons:

- Exploiting the opportunity of data collection through population census to collect poverty information eliminates duplication of efforts and wastage of resources.
- This type of method also facilitate rapid socio-economic growth of the nation through widely available, accessible, current, reliable and authoritative GI for addressing poverty issues in the country.
- Provides opportunity for collecting reliable geospatial information on poverty at a macro scale.
- Reduce cost of generating geospatial information about poverty at macro scale.

Challenges:

- Opportunity of collecting other information (poverty) from population and housing census makes accessibility and exploitation of geospatial data possible from a single source and should be used in future.
- Data sharing through a single source to achieve optimum result and reduce waste is made possible through population census and should be encouraged.
- Opportunities to ensure effective technology transfer in GI technology in the country are possibility through the use of census data that covers the whole country.

Conclusion and recommendation:

The importance of population and housing Census to a nation cannot be over emphasized. It is of great relevance to the economic, political and socio-cultural planning of a country. Thus, reliable and detailed data on the size, structure and distribution of poverty level of a country can be deduced from a well framed Census questionnaire at no extra cost to the cost of operating Census. This detail information system can be gathered at least once in every ten years when Censuses are conducted. The information gathered through this method can be utilized by Government to improve the standard of living of its citizenry.

The inclusion of housing Census as applied in Nigeria's year 2006 census is an improvement over the past census and provides a reliable indicator of citizens well being. This housing census information is indispensable to planners and policy makers in evaluating housing conditions, estimating housing needs and formulating housing policies (census, 2006). In the same way, information on poverty level of the same magnitude with population census will go a long way to provide means of addressing the problems of poverty in developing nations.

The justification for this study therefore lies in the fact that census exercise is perhaps the most effective, efficient and adequate method of collecting information about the people

of any country especially when it is not politicized and inflated. Census exercise is also thorough in terms of administration and wordings. It is also backed by law and has time limit for collection. The incorporation of poverty questions in the census exercise therefore should be encouraged because it adds little to the cost of prosecuting census when compared to what has been spent.

It is therefore recommended that questions that would evoke the desired response on the pattern and size of poverty levels of the citizens of our countries be entrenched in our future census. Gathering the information through census is not enough but using such information to better the lots of our people through job creation and their standard of living is more important and should be encouraged by any Government in power.

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