

# The Potential Role of the GIS in the Assessment of Basic Physical Infrastructure Facilities in Awka Public Housing Estates.

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## Abstract

This research examines the potential role of Geographic Information System (GIS) in the assessment of basic physical infrastructure facilities in Awka public housing estates. It was motivated by a desire to evaluate the status of basic infrastructure facilities in our public housing estates considering the rapid relocation of occupants to private estates and neighborhoods and on the premise that these are model housing estates. Also the rigorous nature in the manual method of assessment has brought so many constraints in public housing management. It identifies the quantity, quality, maintenance and level of residents' satisfaction on the basic infrastructure facilities which are roads, sanitary and non- sanitary facilities, water, electricity, and solid waste disposal facilities. A total of five hundred and six households representing seventy-two point three percent of the total households in five habited estates in Awka, viz Udoka, Ahocol I and II, Iyiagu and Real estates were examined through a fifty-four item questionnaire and analyzed using Arc View GIS 3.2. Results obtained reveal generally that though the quantity of basic infrastructure facilities provided in the estates are fairly adequate, the quality and maintenance of these facilities are poor. The residents of the estates are generally dissatisfied with the provisions. The paper recommends for the digitization of all manual layout designs of estates in our Government offices to be stored into the system for durability, accessibility and flexibility. It also recommends creation of periodic data base for the public housing estates to determine the status of infrastructure facilities.

**Keywords:** Public housing; Basic infrastructure; Infrastructure provision

## 1. Introduction

Infrastructure is an umbrella term for many activities and basic structures and facilities necessary for a country to function efficiently, Ilori (2004). Infrastructure facilities according to Hirschman (1958) refer to those basic services without which primary, secondary and tertiary productive activities cannot function. Obiegbu (2008) also defined infrastructure as the physical framework of facilities, utilities and support system through which goods and services are provided to the public. In its wider sense, infrastructure facilities embrace all public services from law and order through education and public health to transportation, communications and water supply (Mabogunje, 1974; Kahn, 1979). In other words, infrastructure facilities are elements in the package of basic needs, which a community would like to procure for better living.

Obiegbu (2008) grouped infrastructure into two: namely, Physical Infrastructure comprising of roads, water supply, drainage, sewerage, waste disposal system, transportation, power and Social Infrastructure which includes education, health, telecommunication, security, fire-fighting services, social-cultural recreation parks, bank and financial institutions, housing and other services. This research adopts the classification of infrastructure as given by Obiegbu (2008) but with little modifications. It views infrastructure as necessities for both human sustenance and development and therefore categorizes it into two: namely Basic Infrastructure to include roads, water supply, drainage (non-sanitary facilities), sewerage (sanitary facilities), waste disposal facilities, power (electricity supply), housing; and Non-Basic Infrastructure to include transportation, education, hospitals, telecommunication, security, fire-fighting services, social-cultural recreation parks, banks and financial institutions. This is done with the understanding that Basic Infrastructure is the primary human needs that sustain life. In addition, housing is included among the basic infrastructure since its role in human existence cannot be underscored. It is a human imperative without which man's survival is inconceivable. Besides, beyond the fabric, services and the contents of the dwelling, housing includes all that surrounds the dwelling to stimulate healthy living. It is thus an important part of people's lives and as Kicklighter and Kicklighter (1986) apathy assert, people and housing are inseparable. Oruwari (2006) clearly put forward that housing signifies not just the physical structure that provides protection against the elements, but also the environment surrounding the structure including the physical infrastructure, social services and amenities. Housing is not complete and

cannot be enjoyed without the basic infrastructure such as roads, water supply, sanitary and non-sanitary facilities, electricity supply, and waste disposal facilities. Consequently, this research focuses on assessment of the basic infrastructure provision with concentration on the public housing estates.

Our public housing estates generally and especially those in Awka, capital of Anambra State are experiencing various forms of infrastructure deterioration, Okoye (2009). These housing estates are Udoka, Ahocol, Iyiagu and Real estates. While the basic infrastructure are not provided in some estates from design inception, others are either lacking maintenance thereby not meeting the required need or disliked by the residents. There is no reliable data on the true position of the basic physical infrastructure facilities as to help in the rehabilitation of the estates and policy making to promote public housing provision. It was also observed that several occupants of these estates are relocating to other areas in search of housing satisfaction.

This research explores the use of Geographic Information System (GIS) to carry out this needed assessment. It determines the quantity, quality and maintenance of basic infrastructure facilities in the public housing estates in Awka using GIS with a view to provide the needed information to policy makers and to aid provision of satisfactory housing.

## **2. The Study Area**

Awka, the capital of Anambra state was the chosen area for the study. It is located between latitudes 6o131N and 6o151N and longitudes 7o041E and 7o061E. Awka is administratively located in Awka South Local Government Area of Anambra State. It has adjoining boundaries with Okpuno in the North-west, Amansea in the North-east, Nibo and Amawbia in the South-west and Ezinatoand Isiagu in the South-east.

Awka has a population of 301,657 as at 2006 National Population Census conducted in Nigeria (National Population Commission, 2006). The study area lies within the derived Guinea Savanna zone of Nigeria. The inhabitants are Ibos and mostly Christians with few Idol worshippers.

The study housing estates, Udoka, Ahocol, Iyiagu and Real estates are all located along the express way in Awka. The estates are located between latitudes 6o121N and 6o141N and longitudes 7o021E and 7o061E. The housing estates were constructed to reduce the housing problems of mainly the government workers in the state. The figure below shows the location of the selected housing estates under study.

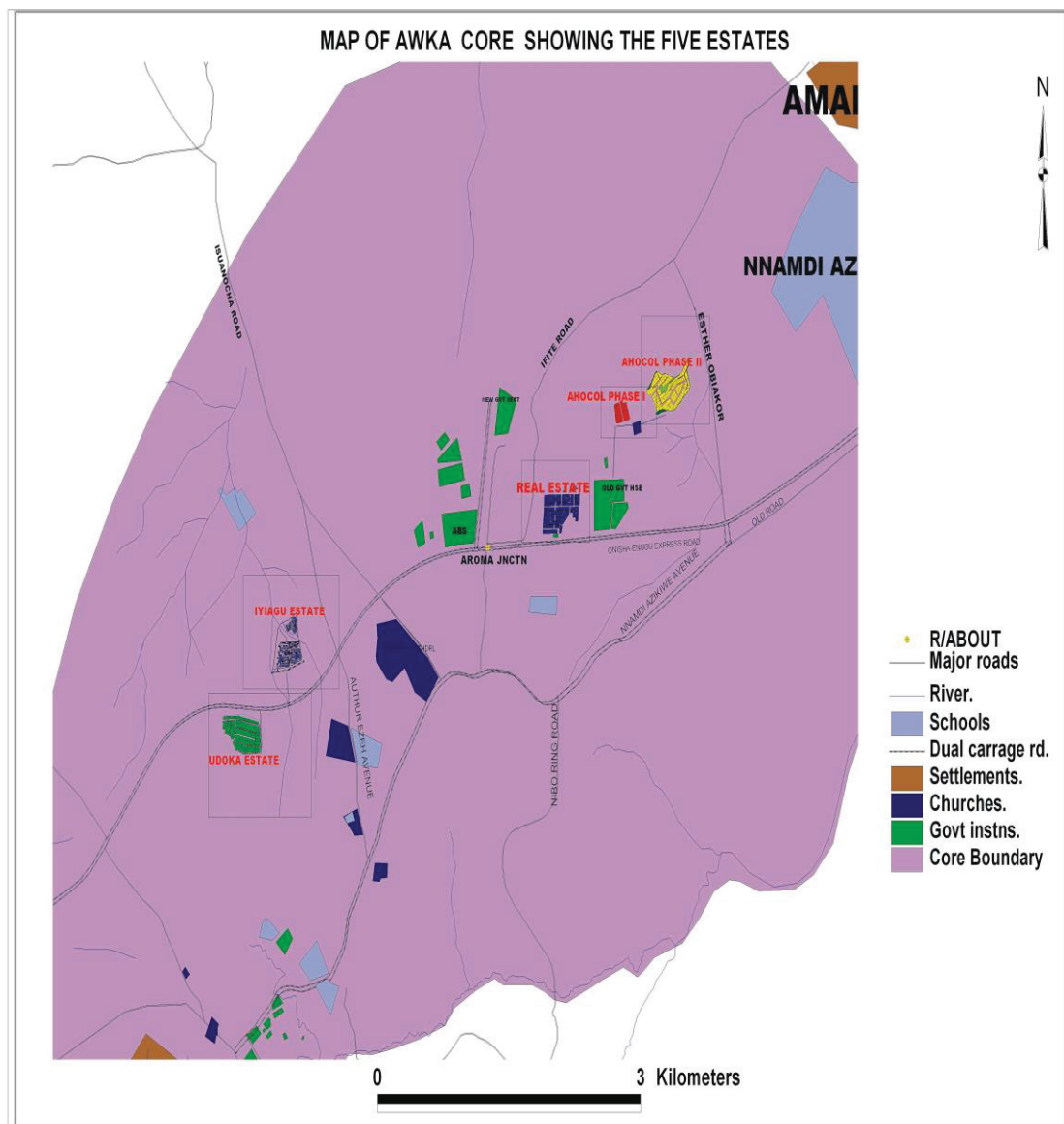


Fig. 1: Map of Awka Core showing the five Estates

Source: Anambra State Urban Development Board (ASUDEB), Awka.

### 3. Research Methods

The study population is the entire 700 households obtained from the 506 habited houses in the chosen public housing estates in Awka. Udoka housing estate has 177, 236 at Ahocol think home estates 1 and 2, 129 at Iyiagu housing estate and 132 at Real housing estates. The above population figure was drawn from a pilot survey of the study estates since the details of the 2006 National Population and Housing Census were yet to be released as at the time of this study. The total number of persons living in the estates was estimated to be 3,930 using an average of 6 persons per household.

As already mentioned the study population constitutes 700 households in the 506 houses of the estates understudy. This represents a one hundred percent of the housing studies in the entire estates. This is to make for a detailed assessment which will give a correct and comprehensive opinion of the respondents and also to provide data on the status of basic infrastructure facilities on each building in the estates.

However, one household per house was examined. This gave a total of 506 households representing 72.3% of the total households. In the entire households in Udoka, 91.5% was sampled, 63.1% in Ahocol 1 and 2, 48.8% in Iyiagu and 83.5% in Real estate. A purposive sampling type of non-probability sampling technique was used to

select the older or oldest household where there is more than one in a house. This is with the understanding that responses from such a household should serve as a representation of the condition or true picture of basic infrastructure facilities provided in that house. A random sampling technique was used to select a household where all the households in a house packed in the same day. Any house where there is only one household, the household was automatically examined.

The questionnaire was administered to household heads, whether male or female. The house numbering system in the estates was used in both identifying the houses and administering the questionnaire. The questionnaire seeks principal information on the assessment of basic infrastructure provision (roads, drainages, water supply, electricity supply, sanitary facilities and solid waste disposal facilities) in the public housing estates in Awka. It comprises of a total of fifty-four structured questions. It is divided into two sections. Section A has eleven questions and is structured in such a way to elicit information on the respondents' demographic data as a means of providing background information and also to obtain suitability of the respondent for the study. Section B has six parts but concentrated on basic infrastructure provision.

Geographic Information System, (GIS) was used to capture all the analogue estate layout designs. These maps were digitized and georeferenced using Arc View GIS software. The responses from each household in the estates were captured, stored, checked, integrated, analyzed, and results displayed in pie and bar charts using the same software.

#### 4.Results

##### 4.1 Respondents' Level of Satisfaction with the Roads in the Estate in Terms of Quantity

Table 1 and figures 2-6 show respondents' level of satisfaction with the roads in the estate in terms of quantity. Quantity in this sense means, the number of roads available in the estate road network. Respondents were asked to choose from the following variables: Strongly satisfied, satisfied, dissatisfied, strongly dissatisfied or undecided.

Table 1. Respondents' Level of Satisfaction with the Roads in the Estates in Terms of Quantity

S/N	Variables	Udoka		Ahocol I		Ahocol II		Iyiagu		Real		Total	%
		No	%	No	%	No	%	No	%	No	%		
A	Strongly satisfied	39	24.2	-	-	2	1.8	4	6.3	13	9.8	58	11.5
B	Satisfied	78	48.1	12	32.4	28	25	28	44.4	67	50.8	213	42.1
C	Dissatisfied	25	15.4	10	27.0	38	33.9	11	17.5	26	19.7	110	21.7
D	Strongly dissatisfied	13	8.0	10	27.0	29	25.9	11	17.5	11	8.3	74	14.6
E	Undecided	07	4.3	5	13.6	15	13.4	9	14.3	15	11.4	51	10.1
	Total	162	100	37	100	112	100	63	100	132	100	506	100

Source: Researcher's field survey, 2008.

In Udoka, 78 or 48.1% responded satisfied followed by 24.1% that answered strongly satisfied. This means that majority of the respondents in Udoka were satisfied with the quantity of roads available in the estate. Udoka estate layout was designed in a way that all the plots have direct road access.

In Ahocol I and II, respondent's opinion spread across dissatisfied, strongly dissatisfied and satisfied. The average could be taken to be dissatisfied. This means that the respondents were dissatisfied with the quantity of the roads provided. Some buildings in Ahocol II have no direct access to roads. They depend on adjoining roads to access their plots. Those that indicated satisfied may be the group that has direct access road.

In Iyiagu and Real, majority indicated satisfied. A total of 44.4% respondents in Iyiagu and 50.7% in Real

expressed satisfaction with the quantity of roads provided.

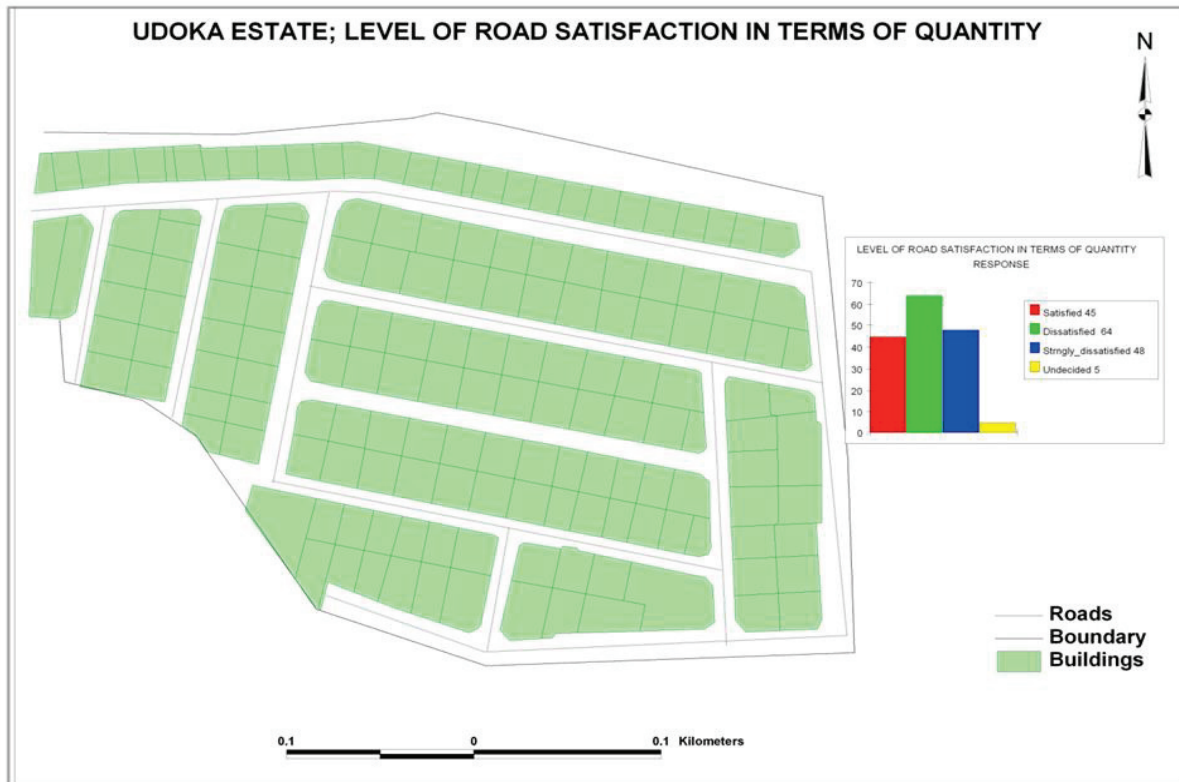


Figure2: Respondents' Opinion on road Satisfaction in terms of quantity in Udoka



Figure3: Respondents' Opinion on road Satisfaction in terms of quantity in Ahocol I

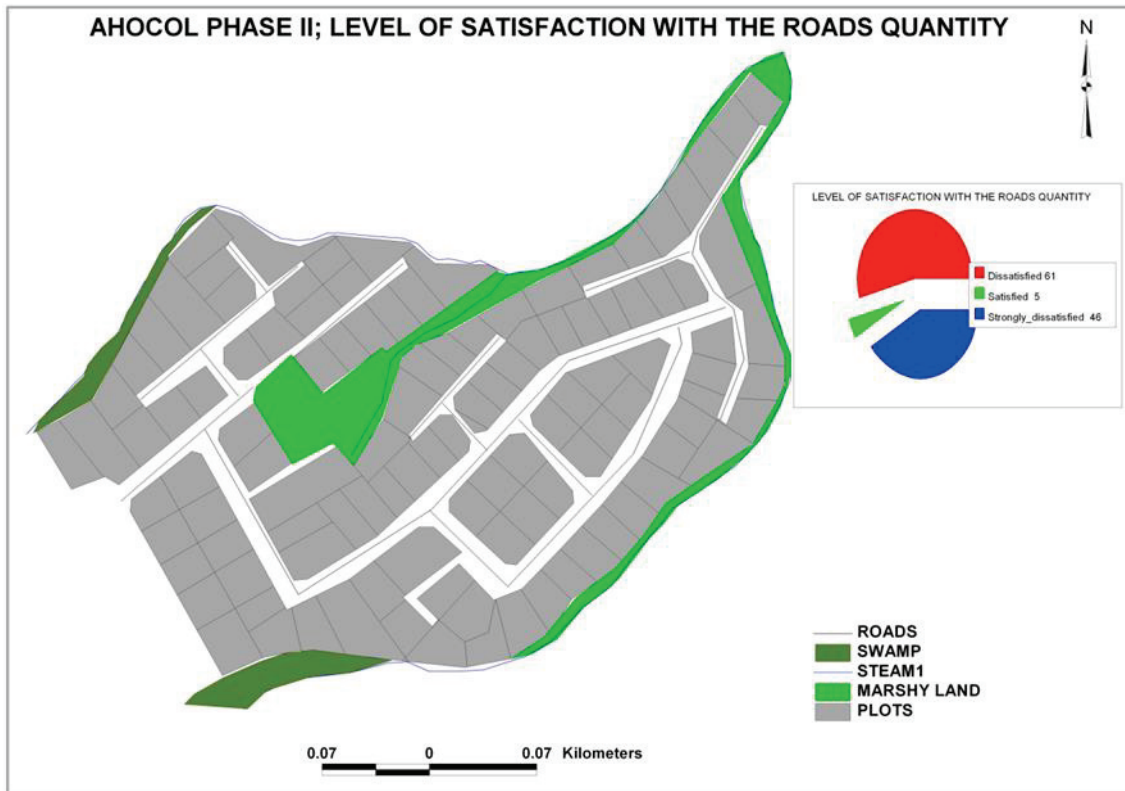


Figure4: Respondents' Opinion on road Satisfaction in terms of quantity in Ahocol II

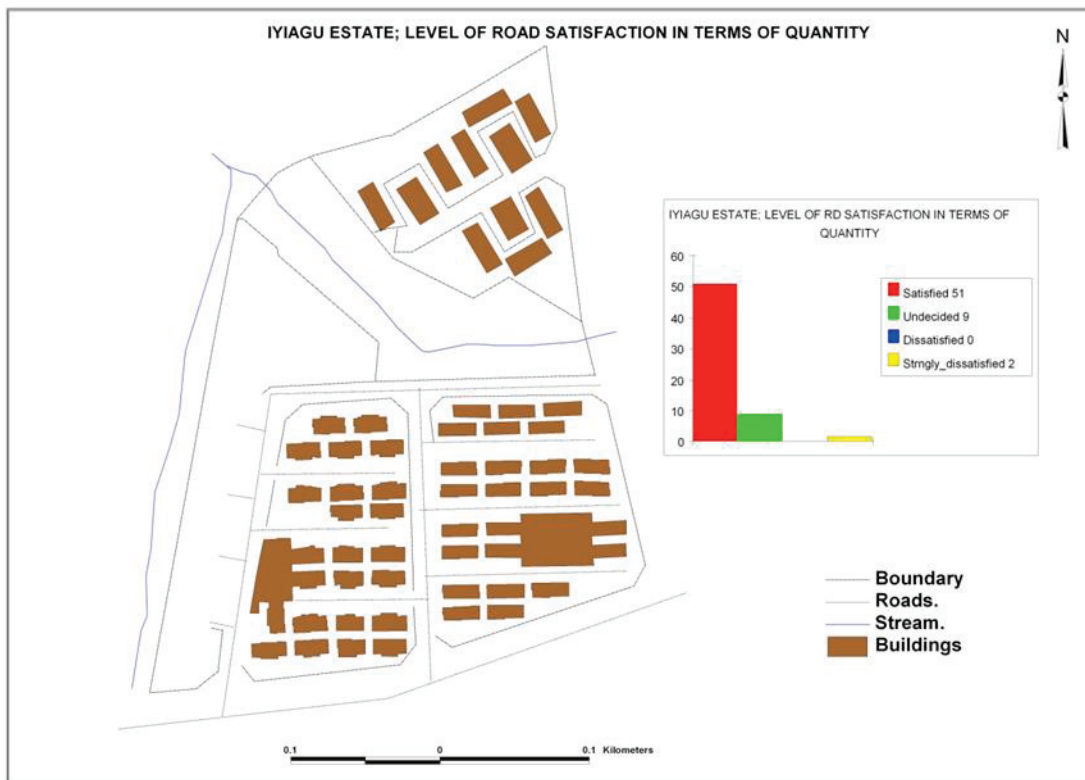


Figure5: Respondents' Opinion on road Satisfaction in terms of quantity in Iyiagu



Figure6: Respondents' Opinion on road Satisfaction in terms of quantity in Real Estate

#### 4.2 Summary of findings on basic infrastructure provision in the estates using GIS.

GIS technique as applied above was used to analyze and display results covering all the questions raised in the research questionnaire. The following are the summary of findings obtained on each of the basic infrastructure facility in the estate.

##### 4.2.1 Roads

1. Majority of the roads in the estates were constructed at the initial stage of the estate development.
2. The quantity of roads provided in all the estates except Iyiagu met the planning standard of between 15 – 25%. Udoka has 22.3%; Ahocol I – 16.1%; Ahocol II – 15.2%; Iyiagu – 10.7% and Real – 23.1%.
3. The quality of roads in all the estates are generally poor. While some are tarred others are not. The enumerated problems experienced on these roads are potholes, erosion, dust, unnecessary road bumps, parking on the roads, and road congestion.
4. Though the government is responsible for the maintenance of the roads, in the estates the research shows evidence that the roads are not maintained at all except with the efforts of the community and individuals.
5. The residents of these estates are generally satisfied with the quantity of roads provided but dissatisfied with the quality and strongly dissatisfied with the maintenance.

##### 4.2.2 Non-sanitary facilities (drainages)

6. Tarred roads in the estates are provided with open concrete drainage channels constructed by the Ministry of works, Awka while untarred road have no drains at all. The performance of the road drains was generally assessed by the respondents to be fair in the places where they are provided despite the problems observed on the field as a result of erosion. Such problems include: potholes, gullies near buildings.
7. The residents experience various drainage problems ranging from gully formation, soil erosion, inadequate drainage width to carry the waste water, blockage by refuse, and low quality drainage construction materials.

8. Drainage channels are maintained mainly through communal effort of the residents.

9. The residents of these estates are generally dissatisfied with the quality, quantity and maintenance of drainage facilities in their estates.

#### **4.2.3 Water supply and facilities**

10. There was no public water supply in all the estates except in Iyiagu where government provided boreholes specifically for the estate from inception. The non-availability of public water supply in these estates is attributed to the on-going administrative problem in the State Water Corporation which has lasted for more than two years now.

11. Residents of the estates depend on various water sources for their daily water needs. These sources are; water vendors, borehole, well, rain water and stream.

12. At Iyiagu estate where there is public water supply, water is not regularly supplied but whenever supplied, the quantity is usually enough to fill all the available household water spaces. The irregularity of water supply is attributed to faults in the borehole and its accessories.

13. Though the government is responsible for the repairs and maintenance of the estate water facilities, the sustenance of Iyiagu estate water supply is purely by communal effort.

14. The residents of Iyiagu estate are generally satisfied with the quantity and quality of water supplied, and also the maintenance of water facilities in the estate.

#### **4.2.4 Electricity supply and facilities**

15. Enough quantity of electricity facilities are provided in the estates from the initial stage of the estate development but electricity supply is not regular. Residents resort to alternative supply mainly, personal power generators, and lantern. They also resort to the use of stabilizing machines to solve low voltage problem.

16. Though the Power Holding Company of Nigeria (PHCN) is responsible for the maintenance of electricity facilities, this has been jointly done most times with either individual households or communal contributions. Even at that electrical faults are repaired after a long time.

17. The residents of the estates are generally satisfied with the quantity of electricity facilities provided in the estates i.e. electric wires, poles and transformers etc. but are generally dissatisfied with the quality of electricity supply and maintenance of electrical facilities.

#### **4.2.5 Sanitary facilities**

18. Most of the households in the estates are provided with septic tank/soak away sanitary facilities by the State Government Agency responsible for the estate and located within the building.

19. The problems experienced by the residents in the use of sanitary facilities ranges from poor quality construction works, lack of maintenance, inadequate facilities, flies and excessive odor.

20. Sanitary facilities are maintained mostly by the households.

21. The residents are generally satisfied with the quantity of sanitary facilities provided in the estate but dissatisfied with the quality and strongly dissatisfied with the maintenance.

#### **4.2.6 Solid waste disposal facilities**

22. Majority of the residents in the estates dispose their solid waste through open space dumping within the estate.

23. The residents of the estates assessed the management of solid waste disposal dumps within the estate to be fairly managed.

24. Though the Anambra State Environmental Protection Agency (ANSEPA) has the obligation to manage the solid waste generated in the estates, evacuation from the dumps takes place after a long time.

25. Though the residents of the estates are generally satisfied with the quantity of solid waste disposal dumps; dissatisfied with the quality and strongly dissatisfied with the maintenance of those facilities, field observation reveals that there are no solid waste disposal facilities or method existing in the estates.



## **5.0 Gains in Applying Geographic Information System (GIS) to Assessment of Basic Infrastructure Provision in Housing Estate.**

The application of GIS in this research has the following gains:

1. Through the application of GIS, all housing estates, layout designs were brought into soft copies. This was achieved through scanning, digitalization and geo-referencing of the estate layout design. It puts away the fear of losing the designs may be by reason of termite attacks, rust and or misplacement of documents and makes the layout design handy, more durable and provides environment for better storage.
2. It makes the housing estates layout designs flexible. Flexible in the sense that adjustment can be carried out with less or no fatigue.
3. Through the use of GIS in assessing housing estate layouts, the geographic coordinates of any plot can be easily obtained and located including measuring of distances.
4. The application of GIS makes the assessment of the facilities in each estate fast, accurate and reliable with quick visual display.
5. It communicates individual household responses from each of the estates on the assessment of the estate facilities and makes way for subsequent comparison.

## **6.0 Recommendations on the Use of Geographic Information System.**

This paper has the following recommendations to make with respect to the use of GIS in assessing public housing infrastructure facilities:

1. That all the manual layout designs in our government offices be digitized and stored into the system for durability, accessibility and flexibility. This provides the best means of storage. While some of the estate layout designs were difficult to locate in the government offices during the research, those located were either toured or eaten up by termites. Some of the lost data on layout designs were retrieved through fresh field observations. The application of GIS preserves materials and data pertaining to the estate.

Consequently, all layout designs and survey maps housed in our various Ministries of Lands, Survey and Urban Planning could be better preserved, stored and easy to transfer through the use of GIS. These Ministries should therefore train their staff on computer appreciation and on the use of GIS.

2. In view of the quick and presentable manner GIS assesses and displays results of georeferenced data fed into the data base, it is recommended for assessment of infrastructure facilities in the public housing estates. To aid this, periodic database could be created for the estates to determine the status of infrastructure facilities. It can be used to detect progression or retrogression of the status of infrastructure facilities and further detects any neglected infrastructure facility.

## **7.0 Conclusion**

The statuses of basic infrastructure facilities in these estates are not readily known probably due to the fatigue of manually carrying out the assessment by the government agencies responsible. This research utilizes and recommends the application of Geographic Information System (GIS) in assessment of the infrastructure facilities. It reduces the fatigue, makes for better data storage and flexibility and represents a good display of analysis for easy decision making adequate for planning, execution and management of public housing estates.

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