Analysis of Urban Functions and Sustainability in the Obudu Urban Area, Cross River State, Nigeria

Tarkar Aondoakaa
Department of Geography
Federal College of Education, Obudu, Cross River State
tarkaraondoakaa@gmail.com
DOI: 10.56201/ijgem.vol.11.no10.2025.pg46.60

Abstract
In light of the surge in urbanization and urban growth and its attendant socio-economic problems and mindful of the projection that this trend will continue into the future, this study makes an assessment of the situation in the Obudu urban area as an emerging urban settlement. The objective is to identify trends in population, aerial growth and supply of social infrastructure. The study used satellite, qualitative and quantitative data and descriptive statistical techniques to analyze identify trends and underlying problems within the study area and proffer solutions. The study found that both the aerial limits and population of the area are increasing rapidly while the supply of social services and infrastructure are drastically lagging behind. Suggestions for improvement include the identification through a database of strengths and weaknesses as well as assets that can be leveraged to support interventions, have immediate and long-term plans to effectively drive development and set measurable targets and milestones.

Keywords: *urban growth, infrastructure, sustainability, development*

INTRODUCTION

Urbanization and urban growth have become important issues confronting today's society. Over the past century, man has increasingly lived in urban areas. It is therefore safe to say that urban areas have becomes man's preferred habitat. For the first time in man's, the majority of the world's populations live in urban areas. In 2014, an estimated 55% (around 3.8 billion people) lived in towns or cities (UNDESA, 2019: 1). The 2018 Revision of World Urbanization Prospects estimates that this proportion will increase to 68% by 2050. Furthermore, future increases in the size of the world's urban population are expected to be highly concentrated in just a few countries. It is estimated that about 90% of urban growth will occur in developing nations, with 80% of urban growth occurring in Asia and Africa (Ankerl, 1986; UNFPA, 2007). Additional estimates show that together, India, China and Nigeria will account for 35% of the projected growth of the world's urban population between 2018 and 2050. By 2050, it is projected that India will have added 416 million urban dwellers, China 255 million and Nigeria 189 million. Projections developed by UNDESA (2019) suggest that Nigeria's urban population will likely double within the next 30 years.

Urban areas have becomes man's preferred habitat because of the benefits associated with urban centers. The UN defined urban centers as centers of growth and development and Grübler and Fisk (2013) have asserted that the economic strength of countries lie in cities. In fact, urban gross domestic product (GDP) represents about 80 per cent of world GDP. Cities have become pivotal centers for economic growth, employment creation, innovation and cultural exchange. Cities in

many developing countries (e.g., Bangladesh, Brazil, China, Honduras, India, Nigeria, Peru and South Africa) concentrate the core of modern productive activities and are the areas par excellence where income-earning opportunities are to found (Satterthwaite, 2007). Cities are also the centers where women enjoy the highest labor participation, health access, literacy rates and upward social mobility (Cohen, 2006). Urban areas also offer higher living standards and opportunities for growth and development.

In any case, with increasing numbers living in towns and cities, existing urban infrastructure in many contexts is struggling to cope with the increased demands of urban residents. Rapid urban expansion and growth has led to urban and suburban sprawl i.e. the unrestricted growth of housing, commercial development, and roads. It is a term that also relates to the social and environmental consequences associated with urbanization. Urban sprawl especially in developing societies like Nigeria presents acute environmental and social problems and is often associated with shortages in the provision of urban service like housing, education, health care, water and energy, longer commutes, traffic congestion and environmental degradation including pollution. These inadequacies in the provision of urban services make them dysfunctional and unable to deliver the potential benefits of urbanization to urban dwellers. This is particularly true of emerging urban areas which have sprang up without efficient planning but are experiencing rapid increases in population.

Aliyu and Amadu (2017) have pointed out that the pattern, trend and characteristics of urbanization in Nigeria have been particularly significant; Nigeria's towns and cities have grown phenomenally with the rate of urban growth consistently above 2% per annum (UNDESA, 2019). Consequently, there has been a rapid expansion of Nigerian cities often in an unplanned and uncontrolled manner (Cities Alliance, 2007). Several studies have shown that inadequate planning of urban land use in Nigeria and intensity of use has exacerbated urban problems such as congestion, air pollution and heat stress (Cities Alliance, 2007; Onibokun & Faniran, 2006).

Due generally to their unplanned nature and their rapid growth, numerous challenges threaten the ability of cities to become viable pillars of sustainable development. Unequal access to and inefficient use of public services as well as financial fragility and the harm inflicted by natural hazards, demand an integrated and coordinated response at the local, national and international levels. This can be achieved only if the peculiar circumstances of the urban areas are studied.

METHODOLOGY OF STUDY

The Study Area

The study area is the Obudu urban area. It is one of the administrative wards in Obudu Local Government Area of Cross River State, Nigeria and the Headquarters of the Local Government Area. The coordinates of Obudu are 6^0 40^0N and 9^0 10^0 E. For the purpose of this study, the study area covers a land area of approximately 166.98 Km^2.

The study area has an estimated population of 170,595 people (based on 2006 census). It has a tropical humid climate with distinct wet and dry seasons with an annual rainfall of between 1300 mm – 2000 mm. The vegetation is transitional with guinea savanna and patches of rainforest.

The area is cosmopolitan in nature with people of different ethnic, religious and economic backgrounds. The main economic hub of the area is agricultural products marketing with many of the residents are involved in agriculture. A large portion of the population is also engaged in public and private sector activities/employment.

RESEARCH DESIGN

The study is a diagnostic and descriptive study. It employed a bouquet of designs including GIS data, field surveys, observation and secondary data analysis.

DATA REQUIREMENTS

The study required both quantitative and qualitative data.
Data was generated for this study from January 2025 to April 2025 from:

i. Two-years multispectral imageries: Landsat ETM+ (2000) and Operational Land Imager (OLI) (2025) which were used for remote sensing analysis of the urban ecosystem and ecosystem services.
ii. Household survey using structured questionnaires. The questionnaires were administered using the stratified random sampling technique. This created data on urban infrastructure and services like housing, health facilities, water availability, land use etc.
iii. Observations, which generated data on urban infrastructure and services.
iv. Focus group discussions and interviews
v. Secondary sources including data on population and employment, this data was sourced from the National Population Commission, the National Bureau of Statistics and the Obudu Local Government administration.

The main variables for this study were:

i. Aerial expansion, Population growth, Domestic energy supply and use, Solid waste collection and disposal, Water supply, Poverty level, Public transport, Economic base, Employment, Education, Health care provision, Residents expectations

TECHIQUES OF DATA ANALYSIS

i. Tables, charts and percentages
ii. SWOT analysis – this brought out the strengths, weaknesses, opportunities and threats of the study area.
iii. Satellite data imageries was processed and analyzed using GIS software
iv. Rating scales (adapted from The Inter-American Development Bank (IDB) Emerging and Sustainable Cities Initiative (ESCI). These scales are used to rate the city's performance on specific indicators.

Remotely sensed data

Basic information on remotely sensed data

Remotely sensed data from satellites comprising two-years multispectral imageries: Landsat ETM+ (2000); and Operational Land Imager (OLI) (2025) were used to decipher trends in spatial growth in the study area. The Landsat imagery dataset was sourced from the Earth explorer platform from United States Geological Surveys (USGS). The study area map was extracted using geometric coordinate system from Google earth pro satellite images for geo processing.
Changes in land cover were measured using time series of remotely sensed data ETM and Operational Land Imager (OLI). Images of the two data sets were acquired from 1st to 30th May in 2000 and 2025to ensure that the images fall within the period of 25 years. Ancillary data included the ground truth data for the LU/LC classes. The ground truth data was in the form of reference points collected using Geographical Positioning System (GPS), high resolution Google earth images were also used to aid in classification and overall accuracy assessment of the classification results.

Image pre-processing and classification

Data collected was preprocessed in ERDAS imagine 12 and ArcGIS 10.8 for band combination and sub-setting of the image on the basis of Area of Interest (AOI).

Accuracy assessment

This study adopted the Error Matrix approach (ERRMAT in ArcGIS) to assess the accuracy of the classification. The error matrix assesses accuracy using four parameters: overall accuracy, user's accuracy, producer's accuracy and the Kappa Index of Agreement (KIA).

3.5.4 Classification of Accuracy Assessment

The classification accuracy and Kappa index of agreement for the two periods of 2000 and 2025 for Obudu urban area were calculated and the result is presented in table 1.

Table 1. Accuracy assessment result of LULC classification

LCLU Name	**2000**		**2025**	
	Producer (%)	**User (%)**	**Producer (%)**	**User (%)**
Forest cover	97	*95*	95	*96*
Farmland	93	*93*	88	*92*
Built up Area	79	*90*	77	*95*
Water body	98	*93*	95	*95*
Bare surface	84	*77*	86	*65*
Overall	***91%***		***90%***	
Kappa	***0.91***		***0.92***	

DATA ANALYSIS, RESULTS AND DISCUSSION OF FINDINGS

Trends in spatial urban growth in the study area

DIGITAL IMAGE ANALYSIS FOR OBUDU (2000-2025)

Satellite imageries of Obudu urban area in 2000 and 2025

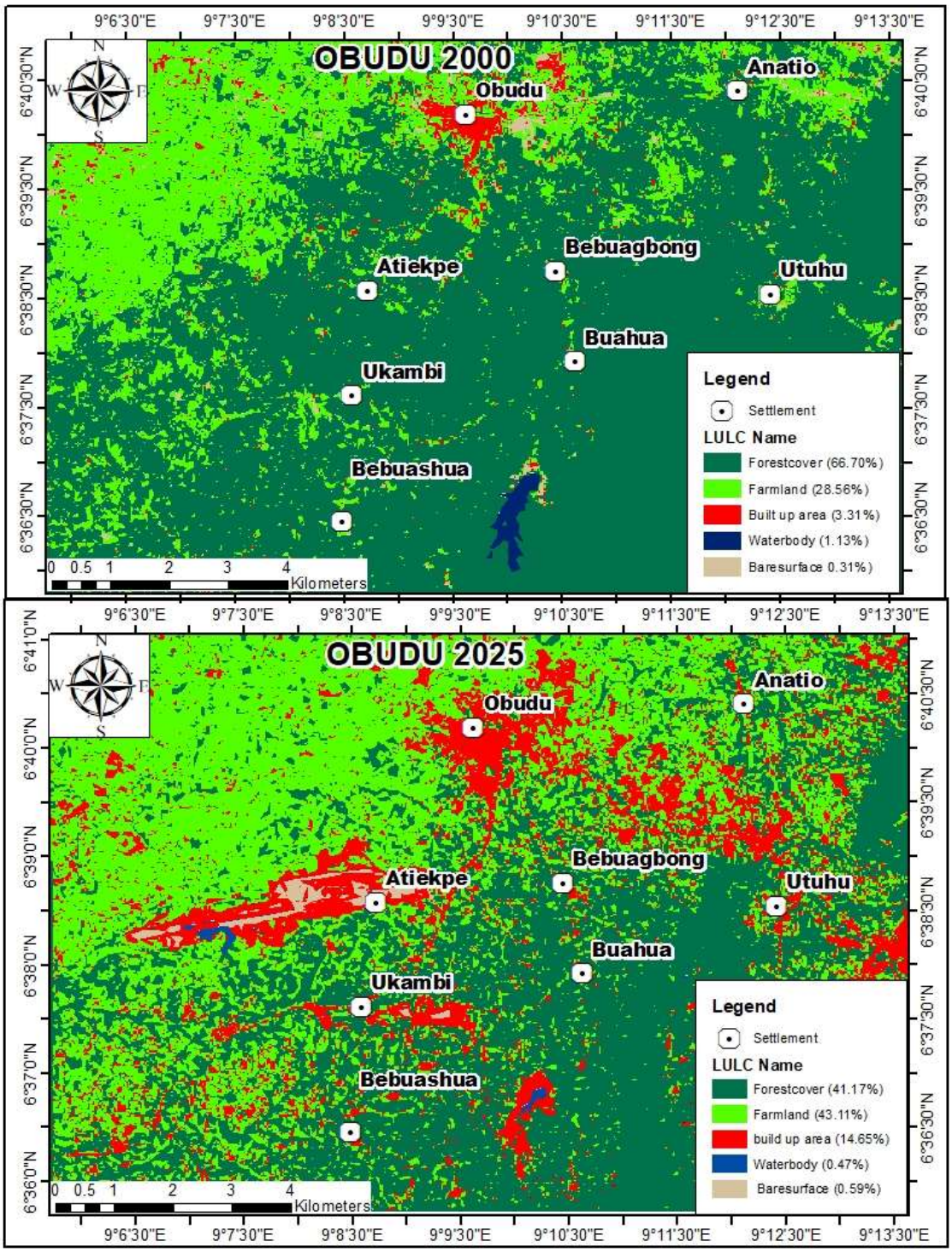

Table 2. Digital image analysis for Obudu (2000)

S/N	LULC Name	Area(km^2)	%
1	Forest	111.37	66.70
2	Farmland	47.68	28.56
3	**Built up area**	**5.53**	**3.31**
4	Water body	1.88	1.13
5	Bare surface	0.52	0.31
		166.98	100.00

Table 3. Digital image analysis for Obudu (2025)

S/N	LULC Name	Area(km^2)	%
1	Forestland	68.75	41.17
2	Farmland	71.99	43.11
3	**Built up area**	**24.47**	**14.65**
4	Water body	0.79	0.47
5	Bare surface	0.99	0.59
		166.98	100.00

Table 4. Land use land cover change Statistics for Obudu town and its environs from 2000 to 2025

LULC Class	2000		2025	
	Area (Km^2)	Area (%)	Area in (Km^2)	Area (%)
Forest cover	111.37	66.70	68.75	41.17
Farmland	47.68	28.55	71.99	43.11
Built up area	**5.53**	**3.31**	**24.47**	**14.65**
Water body	1.88	1.13	0.79	0.47
Bare surface	0.52	0.31	0.99	0.59
Total	166.98	100.00	166.99	100.00

Table 5. Differences in land use /land cover change in Obudu town and its Environs from 2000 to 2025

LULC Class	**2000-2025**		
	Area (Km^2)	**Area (%)**	**Percentage change in LULC (%)**
Forest cover	-42.62	-25.53	61.73
Farmland	24.31	14.56	151
Built up area	**18.94**	**11.34**	**442**
Water body	-1.09	-0.65	42
Bare surface	0.47	0.28	190

Table 6. Annual Land use /land cover changes in Obudu town and its environs from 2000 to 2025

LULC Class	**2000-2025**	
	Area in Km^2	**Area (%)**
Forest cover	-1.70	-1.02
Farmland	0.97	0.58
Built up area	**0.76**	**0.45**
Water body	-0.04	-0.03
Bare surface	0.02	0.01

Urban land use (urbanization) around the Obudu urban area and the outskirts has increased over the past 25 years. Satellite image analysis shows a 442% increase in the built-up area around Obudu within the aforementioned time span.

Trends in population growth in the study area.

Table 7: Population trends in the Obudu urban area from 2000 - 2025

YEAR	**Estimated population of Obudu LGA(people)**	**Estimated population in Obudu town and the outskirts (people)**	**Percent (%)**
2000	124,938	56,222	45
2025	310,173	170,595	55
% increase in the urban population from 2000 - 2025			**303**

Estimates based on the 2006 population census

Population growth around the Obudu urban area is increasing rapidly. A 303% increase in population has been observed within the area since the year 2000

Problems of settlement growth in the study area

Table 8: Key urban services/ indicators and their rating in the Obudu urban area.

Serial #	Topic	Sub-topic	Indicator	Description	Rating Scale (100 – 00)		
					100 – 70 sufficient	69 - 40 Deficient	Below 40 Critical
1.	Water	Water availability	functional House hold Connection to public water supply	Available and functional piped public water supply	-	-	00
		Water quality	Clean, safe and Continuous water supply	Sources of water available to households	-	55	-
2.	Energy	Energy availability	House hold Connection to Public energy supply	Available and functional public energy supply	87	-	-
		Industrial Energy use	Energy used for production Of goods/services	Energy used for the production of goods/ services	-	-	38
3.	Waste management	Waste collection	Presence of waste collection bins and centers	Households waste Collection and storage methods	-	-	08
		Waste disposal	Presence of public waste Collection and disposal system	Methods of waste collection/ disposal	-	-	05
4.	Poverty	Average income	People earning $2/day	How many people live above the poverty line	-	64	-
		Poverty reduction efforts	Resources/ programs for poverty reduction	Government efforts at reducing poverty .	-	-	06

5.	Transport	Transport mode(s)/ network	Spread of maintained transport network in relation to total area	Paved streets and roads in the area	-	55	-
		Availability of Public transport	Nature/ coverage of public transport	Organization and spread of public transport	-	-	25
		Availability of air transport	Presence of a functional airport	Accessibility to air transport	-	-	00
6.	Economy	Production base	Output of goods and services	Quality and accessibility of support for businesses	-	47	-
		Innovation and entrepreneur-ship	Number of new businesses in the area.	New goods/ services produced in the area	-	-	21
7.	Employment	Formal employment	Formal employment as a proportion of total employment	People employed in the formal, organized sector	-	-	32
		Informal employment	Informal employment as a proportion of total employment	People employed in the informal sector	-	57	-
8.	Education	Basic/ Secondary education	Number of basic/ secondary educational institution in relation to the population	Number of basic/ secondary educational institutions available	72	-	-
		Tertiary education	Number of tertiary institutions in relation to the population	Number of tertiary institutions available	-	56	-

9.	Health care	Health care availability	Number of hospitals in the area	Heath centers and Doctors available in the area	-	62	-
		Health care affordability	Health Insurance coverage	Population covered by health insurance	-	-	17
10	Housing	Presence of slums	Population living in slums, informal settlements, or inadequate housing	Population living in poor quality housing and environments	-	-	35
11.	Connectivity	GSM/ Internet coverage	Population covered by a mobile network	Access to GSM /internet coverage	85	-	-
12.	Residents expectations	Satisfaction	Level of satisfaction	How much residents expectations are met	-	-	38
		Annoyance	Level of annoyance	How much residents expectations are met	-	59	-

Several problems exist due to the rapid growth of Obudu as an urban center. The problems center on the inability of social infrastructure and services to grow in tandem with the population and land use growth. Acute shortages exist in the areas of water supply, energy availability and use, waste management, transportation, housing, employment and poverty reduction. Generally, residents' satisfaction with the level of social services and infrastructure is very low.

Tackling the problems of urbanization in the study area

SWOT ANALYSIS

Table 9: SWOT analysis for Obudu urban area

STRENGHTS	**WEAKNESSES**
Naturally preserved area Natural scenery maintained low pollution Strong historical and cultural heritage Education center Economic centre for the surrounding rural areas and products Fairly developed road network Fairly developed health infrastructure Seat of Local Government with federal financial inflow Open to air transport Availability of agro raw materials	Rapidly growing, perhaps too fast considering the available technology and resources. Low social infrastructure and outdated technologies (water, waste treatment, transportation) Poor long term planning Low community awareness for the environment, innovation and development High under employment and informal employment Low financial inflows Inefficient management of city finances Low investment both in the private and public sectors High dependence on federal allocations
OPPORTUNITIES • Tourism and hospitality • Transport • Real estate and housing • Agro-processing • Federal and state government support	**THREATS** Very low financial inflow and investment Poor planning, Poor financial and environmental management Poor innovation strategies

SWOT analysis shows the areas of strength, weakness, opportunities and threats. Findings reveal that no deliberate, planned efforts/ programs are in place to tackle the problems emerging due to the rapid expansion of the area by Obudu LGA administration. The LGA administration, saddled with managing the emerging city is faced with severe shortages in revenue.

Discussion of findings

Trends in spatial urban growth in the study area

Analysis of the photo imageries of Obudu in the years 2000 and 2025 and presented in table 3 -7 show that the Obudu urban area has witnessed extensive growth and expansion in the last 25 years. The imageries cover an area of 166.98 km^2 around the Obudu urban area. Of this area only 5.53 km^2 or 3.31% is described as built up in 2000. The built-up area includes the main town and the surrounding outskirts. In 2025, the built-up area has increased to 24.47 km^2 or 14.65% of the total area showing an increase of 18.94 km^2 of the land i.e. 11.34% of the land and a 442% increase in the initial built up area. Image analyses show an annual urbanization increase of approximately 0.45%.

This analysis is consistent with the literature, which shows that the world is urbanizing and urbanizing rapidly especially in the developing world (Ankerl, 1986; UNFPA, 2007: UNDESA, 2019: 1.)

Trends in population growth in the study area.

Population figures for the Obudu Urban Area are scanty. The figures available are estimates or projections based on figures from the 2006 population census. Available estimates put the population of the LGA at 310,173 people in 2025. About 55% of this population i.e.170, 595 people is estimated to be living in the major urban center and the surrounding outskirts. The population of the LGA was estimated to be about 124,938 people in the year 2000 with an estimated urban population of 45% i.e 56,222 people. This puts the estimated urban growth in population at 303% meaning that the urban population has tripled within the past 25 year period. This growth in populations aligns closely with the spatial expansion of the area.

Problems of rapid growth in the study area

Unplanned and uncontrolled urbanization comes with problems. Data analysis has shown that the study area has several problems occasioned by the rapid urban growth within the past 25 years.

Using the Emerging and Sustainable Cities Initiative (ESCI) methodology for analysis, the study has identified problem areas that need urgent attention, areas that while not healthy can be managed and areas that are healthy.

From the analysis, energy, education and GSM connectivity seem to be doing well since they all have wide coverage and availability. In any case, the quality of these services is questionable. In terms of energy, most homes and businesses are connected to the national grid but the quality of energy delivery is not satisfactory, hours of energy supply and voltage are consistently below expectations. Energy use for industrial purposes is very limited which is not good for an emerging settlement that should be innovative and creative.

Educational services are highly rated in the study area. Basic and secondary institutions are available and well spread. Facilities and infrastructure in these schools are however not adequate. There are also three tertiary institutions in the study area.

GSM connectivity and internet use have wide coverage but again the services are slow and in many cases unreliable.

Transportation in the study area is developing. The main mode of transport is road, the road network within the area is fairly developed; many streets within the town are paved, some with walkways. However, public transport is not well developed, the major means of public commute in the study area is motor bikes; taxis and buses are largely unavailable except for out of town shuttles. Rail transport is not developed but there is an air strip that can take in light aircraft.

Water distribution and quality is another area of concern. Piped public water supply is not functional. There is a public water supply scheme but it is not functional. People source for water from different sources including borehole, well and water hawkers. This creates questions about water availability and quality.

Public waste collection and disposal are practically non-existent. Households do not have waste collection bins and waste collection trucks are seen only occasionally. Wastes are usually deposited by the way side and it is weeks before they are collected. Others bury or burn their wastes. This poses serious health and aesthetic concerns.

Housing is also in a pathetic situation. Most houses are substandard, some without basic sanitary facilities, indeed most of the settlement can be described as slum since there is basically a deficit

in social facilities like water and electricity. Houses are mostly overcrowded and built with substandard materials.

Health care is available in the study area with a good spread of health centers and hospitals. In any case health delivery is not necessarily affordable since most of the residents are not covered by health insurance, since they are mostly in the informal sector. In view of the above, most residents resort to traditional herbal medicine and self-medication for their health care needs.

Another area of concern is employment and poverty. According to the Nigeria Economic Summit Group (2024), Nigeria's unemployment rate stands at 5.3%. Statista (2024) however upgrades this rate to 2.99%. In any case, the informal sector accounts for more than 80% of employment. In fact NESG puts the formal sector employment at 7.3%.

Findings from this study show that less than 20% of the sample is unemployed. Of the employed, less than 40% are in the formal sector while more than 50% are in the informal sector (mostly self-employed). This presents a complex situation where while most employed earn an income above the poverty line of $2/day, the incomes are not high enough to ensure a high quality of life, coupled with the high dependency ratio, poverty is high and the quality of life is low. Efforts/programs aimed at reducing the poverty level are mainly from the Federal Government and the impact has not been felt in the study area.

Any meaningful effort at development must factor in the expectations of the recipients expressed through their level of satisfaction or annoyance. In the study area, findings reveal that the level of satisfaction is low (respondents showed only a 35% approval for the infrastructure and services offered in the study area.

Tackling the problems of urbanization in the study area

A SWOT analysis of the study area was done to bring out the strength, weaknesses, opportunities and threats to the settlement. This analysis gives an indication to which areas need urgent attention to bring about growth and development. It behooves on the city administration to leverage the areas of strength and opportunities by investing heavily in these areas and making improvements in the areas of weakness and threats.

Presently, not much meaningful, deliberate planned efforts/programs are in place aimed at improving the situation on ground.

Conclusion

Urbanization is a positive step towards development. Rapid unplanned and uncontrolled urbanization is a curse. Indeed, it is often asserted that the battle for sustainable development will be won or lost in cities. How cities handle their development objectives will have far-reaching long term effects on their immediate communities and the global community.

REFERENCES

Akolade, G. O (2007). Effect of Urbanization on Sustainable Development in South-West Nigeria; PhD Research, unpublished, Department of Economics, University of Lagos, Nigeria

Alagbe, O. A. (2006). *Challenges of Rise in Urban Slums in Cities in Developing World: A Case Study of Lagos State*. Paper presented at the international conference on The Built Environment: Innovation Policy & sustainable Development, Covenant University, Ota, Ogun; January 24-26

Aliyu, A. & Amadu, L. (2017). Urbanization, cities, and health: The challenges to Nigeria – A review. *Annals of African Medicine (N.D.).* 16 (4)

http://www.annalsafrmed.org/article.asp?issn=15963519;year=2017;volume=16;issue=4;spage=149;epage=158;aulast=Aliyu;type=0

Ankerl, G. (1986). *Urbanization Over Speed in Tropical Africa*. Geneva, INU Press,

Beardsley, K. Thorne, J. H. Roth, N. E. Gao, S. & McCoy, M. C. (2008). Assessing the influence of rapid urban growth and regional policies on biological resources. *International Journal of Landscape Ecology, Planning and Design.* doi:10.1016/j.landurbplan.2009.07.003

Bloch, R. et al. (2015). Urbanization and Urban Expansion in Nigeria. *Urbanization Research Nigeria.*

http://urn.icfwebservices.com/Media/Default/Research%20Reports/URN%20Theme%20A%20U r banisation%20Report%20FINAL.pdf

The Cities Alliance (2007). Foundation for Urban Development in Africa. The Legacy of Akin Mabogunje. *The Cities Alliance*.

http://documents.worldbank.org/curated/en/482851468202163524/pdf/481540WP0urba n10Box338889B01PUBLIC1.pdf

Cohen, B. (2006). Urbanization in developing countries. *Technology in Society*. 28. pp. 63-80

Dawam, P. D & Ebehikhalu, O. N (2007), The Impact of urbanization on Nigerian environment, urbanization resource exploitation and environmental stability in Nigeria; *Book Of Proceedings Of The 49th Annual Conference Of The Association Of Nigerian Geographers (ANG),* 15-19 October 2007

Ejaro, S.P. (2009). Urbanization and land cover change in the federal capital territory, Abuja. Issues and challenges for sustainable development, *Journal of Economics and Allied Fields;* 4(1). P.14-17

Ejaro. P, J, & Abubakar, A. (2013). Impact of rapid urbanization on sustainable development of Nyanya, Federal Capital Territory, Abuja, Nigeria. *Research Journal of Social Science and Management. 03(02).*

Global Platform for Sustainable Cities [GPSC], 2018). *Urban Sustainability Framework*. The World Bank. Washington DC

Khan, H. (2008). Challenges of sustainable development: rapid urbanization, poverty and capabilities in Bangladesh. *Munich Personal RePEc Archive*. unpublished

Luck, M. Wu, J.(2002). A Gradient Analysis of Urban Landscape Pattern: A Case Study From the Phoenix Metropolitan Region, Arizona, USA. *Landscape. Ecology.* 17. Pp. 327–339.

Onibokun, A, Faniran, A. (2006). Urbanization and Urban Problems in Nigeria. *Urban Research in Nigeria* http://www.books.openedition.org/ifra

UN Habitat (2006), *State of the World's Cities.* UN habitat. www.unhabitat.org

United Nations Population Funds. (2007). *State Of The World Population And World Population Prospects. Unleashing the Potential of Urban Growth.*

http://web.unfpa.org/swp/2007/english/chapter_1/urbanization.html.