A COMPARATIVE STUDY OF URBAN EXPANSION AND ITS SOCIO-ECONOMIC IMPACT ON AWKA AND ONITSHA IN ANAMBRA STATE OF NIGERIA

BY

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ABSTRACT

Urbanization is believed to be a driving force of an economy which facilitates the transfer of surplus labour from the rural agricultural sector to the urban industrial sector and contributes to economic development. However, unplanned urbanization can at times boomerang, exerting negative impacts that not only adversely affect the economy but also stimulate environmental degradation. This study examines a Comparative Study of Urban Expansion and Its Socio-economic Impact on Awka and Onitsha in Anambra state. The objectives of this study are to examine land use and land cover change between 1988-2018; prediction of urbanization trend from 2018 to 2030; to examine the socio-economic impact of urbanization in the study area; and to identify appropriate measures for sustainability in the study area. Data used in this study were derived from Satellite images, questionnaire survey, key informant interviews, government and published sources. The method of analyses used in mapping Land Use and Land Cover involves the use of satellite images of LandsatTM of 1988, ETM of 2003 and OLI of 2018. On the basis of this finding, make a projection for the future growth by 2030 using Geospatial Techniques. Also, to ascertain the socio-economic impact of urban expansion in the area, and identifying appropriate measures for sustainability, data were collected from field survey through the administration of questionnaire and was analyzed using descriptive statistics for presentation of results in form of tables and bar-chart for pictorial view. Results indicate that in Awka, the land cover (Vegetation) reduces from 7007.58 hectares (40.98%) in 1988 to 5521.14 hectares (32.31%) in 2018 as a result increase demand for land due to increasing population. Also, the built-up area was observed to be in increasing order from 1202.76 hectares (7.03%) in 1988, 2987.19 hectares (17.47%) in 2003 and 5246.73 hectares (30.70%) in 2018. Comparatively in Onitsha, the land cover (Vegetation) reduces from 839.07 hectares (29.14%) in 1988 to 399.69 hectares (13.88%) in 2018. Also, the built-up area was observed to be in increasing order from 574.83 hectares (19.96%) in 1988 and 1199.25 hectares (41.65%) in 2018. The study also observed that the location of educational establishment in Awka is a major driving force behind the growth of the city and the market centers in Onitsha, while residential expansion of low-income earners at the periphery of the city account for the spatial expansion. The study observes that the Business District and the core areas continued to be dilapidated while the decay in infrastructural facilities worsens. The new areas were also discovered to lack portable water supply, electricity, as well as motorable roads. The study recommends regular monitoring of urban growth and its direction using integrated remote sensing and GIS approaches to determine the pattern of land use/cover as well as guide the provision of urban services and infrastructures to enable sustainability. In addition, the government should subsidize the peri-urban farmers so as to empower them in order to compete in the market and utilise its opportunities.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Urbanization has being a universal and important social and economic phenomenon taking place all around the world. This process, with no sign of slowing down, could be the most powerful and visible and anthropogenic force that has brought about fundamental changes in land cover and land scape pattern around the globe. Rapid urbanization and urban growth, especially in the developing world, is continuing to be one of crucial issue of global change in the 21th century affecting the physical dimension cities.

A shift in the urbanization trend during the latter parts of the 20th century could be seen; from being a movement primarily taking place in the developed world it changed to becoming an occurring event in the developing world. In fact, the rate of urban growth in many developing countries is the fastest ever seen in our planet. Prognosis shows that the urban population is expected to continue to grow all over the world and are predicted to almost double from 2010 till the year 2050 when 6. 4 billion people are estimated to live in urban areas, an increase that almost entirely will take place in the developing world (UN-HABITAT, 2012).

In most countries, urbanization is recognized as a crucial phenomenon of economic growth and social change as it offers increased opportunities for employment, specialization, production of goods and services. This has initiated a large number of people to migrate from rural to urban areas. As a result, cities are growing faster than ever (physical dimension), being a huge center for residence, industry, trade and investment, communications, infrastructure, social services etc. However, this growth

also triggers numerous problems. Environmental pollution and degradation, increased environmental hazards such as flooding, pollution explosion, insufficient sanitation and water supply, transport problems, poor housing conditions, rising cost of living and wealth inequality, and increased in crime, and loss of fertile agricultural & wetlands are some of the most prominent negative effects of rapid urbanization and urban growth (UN-HABITAT, 2012) and most above all is climate change due to the effect of GHG. According to UN Habitat (2012), cities contribute to 70 per cent of global Green House Gas emissions whilst occupying only 2 percent of the world's land. Thus urban areas are disproportionately responsible for climate change. This problem is projected to become more acute in the future. If not manages properly, this may intimidate the sustainable development of cities in the long run.

In Indonesia, the trend of urban transformation in Jabodetabek Megacity has been driven by economic expansion such as industrial complex and new satellite towns, and it has resulted in extended areas of mixed land use of city peripheries (Rustiadi *et al.*, 2009). Jabodetabek Megacity becomes a center of national activities that are characterized by high population density and spatial interaction between regions. The size of population and high economic growth in this area led to significant increased demand for space. Those two components become the factors of urban expansion and high rates of land-use conversion into industrial areas and settlements in Jabodetabek Megacity. From the research can be seen that land use conversion that occurred from agricultural land to non-agriculture land in Jabodetabek Megacity was about 69,362 ha in the period between 1992-2001. According to Rustiadi *et al*. (2009) regarding LUCC that the trend of built up area in the Jabodetabek Megacity continues to increase from 1972 to 2005, and now greenery area in that region were only about 9% of the total area.

In Nigeria, the last four decades have been characterized by rapid urbanization. From a total of less than 6 million in 1960, the urban population in Nigeria has risen by 1982 to over 19 million, in 2006 to over 140 million (NPC, 2008). Settlements grow in size and became more complex with the passage of time. The major pattern of city expansion in Awka as well as Onitsha is rural - urban migration and by natural population increases. This is due to the perverted policies of location of socio-economic activities in favor of the town. The growth of settlements in human numbers leads directly to the areal expansion of the city. These rapidly growing cities spread into the suburban areas and extend along the main roads that lead into the cities thereby increasing the total areas occupied by such settlement.

Before the creation of Anambra State, Awka people were broadening their economic base by engaging in various kinds of crafts activities particularly, black smiting, wood carving, ivory carving, and art work; while others were engaging in other non-agricultural activities like herbal healing and trade. The blacksmith developed the apprenticeship system where they groomed the younger ones in their trade purposely to ensure succession. Several smiths traveled out or even migrated to other settlements in order to get a wider range of clientele and increase their sales. With time, Awka smiths became widely renowned. They made numerous implements such as Otonsi (staff of peace), Oji (staff of mystical power), Ngwuagiliga (staff of ozo men), and metal bells; musical instruments like iron gongs and also, Alo (the big ogene); and war implements namely spear, dagger, and later, Dane guns. But in August 1991 with Awka as Anambra state capital, the town had played different roles as administrative/zonal headquarters to different Governments. In these roles the city had remained more rural than urban in scope and essence. This had to change as soon as it became a State Capital. The influx of population made up mainly of returnee civil servants from Enugu, employees of

federal ministries and parastatals, student population of Nnamdi Azikiwe University and others, brought tremendous pressures on existing infrastructure and services.

More so, Onitsha has exercised a great deal of political, economic, and social influence over the state including the neighbouring towns. The Central Business District of Onitsha is around the main market, which is one among many. The influx of traders from all parts of the country and Cameroon invariably contributed to the town's physical and population growth. The low price of commodities in Onitsha market, the wide range of goods, and the accessibility and low cost of transportation to and from the town continue to draw people. Onitsha's location on the Niger River is advantageous; in addition, the bridge over the Niger makes the town the only gateway between south-eastern and south-western Nigeria. The rapid growth in the size of the town and the market coincided with the period of formal occupation of southern Nigeria by the British when Onitsha market became a daily market. Over the last 200 or 300 years, Onitsha became the commercial hub of Nigeria, the focal point of canoe traffic bringing yams, beans, rice, maize, and imported merchandise from the upper Niger, the Benue valley, and the coast through Benin, Warri, and Sapele. Onitsha has historically been a collecting and distributing centre rather than a production centre, and this explains its vast trading area, which includes places as distant as Kano, Sokoto, Maiduguri, and Jos. Onitsha also grew to become a major industrial, educational, religious, and administrative centre. As an industrial centre it now houses the largest number of industries in Anambra State. As a major religious centre, it has the largest cathedrals for both the Anglican and Roman Catholic churches, east of the Niger. And as an administrative centre, Onitsha houses two local governments and has high courts and other government institutions. Onitsha's growth and trading roots have resulted in

cosmopolitanism, with non-indigenes resulting for more than 70 percent of the total population.

Rapid urbanization has resulted in sharp land cover changes. Land use and land cover changes play an important role in local and regional environmental condition of a particular territory and they are linked to global environmental change. Cities in most developing countries like Nigeria have been undergoing unprecedented changes both in population and spatial extent (Ogunbodede *et al.,* 2013) and as a result are faced with a variety of problems such as uncoordinated land development, conflicting land uses, high densities in certain parts of the urban area and the absence of adequate road network which could ensure efficient intra-urban mobility within the city. One of the most important features of all of these centers is their increasing territorial extent and attendant poor spatial pattern of land use developments which are largely uncontrolled and unmonitored due to paucity of data and non-application of modern technology of information acquisition extent (Ogunbodede *et al.,* 2013).

Recently, an increasing concern about sustainable development have fostered a new interest of the international literature on the physical dimension of cities and, particularly, on the issues of urban growth pattern and urban form (Gezahegen, 2013; Van de Voorde *et al*., 2009). Studies have been conducted focusing on the phenomenon of urban sprawl and informal settlement and their adverse environmental and socio-economic consequences as opposed to the concept of compact and formal development (Dubovyk *et al*., 2011). However, following the growing demand for empirical data and systematic analysis of urban growth processes and patterns, there is an increasing curiosity on the development of quantitative methods of urban analysis. It is significant to provide valuable information to help local and regional land planners to better understand the urban growth process and make informed decision. Sustainability as a

concept is the best to identify and proffer solution to urban challenge by promoting properly planned and managed cities that could support a high density population with a limited impact on the environment with benefits for the economy and the human health.

1.2 Statement of the Research Problem

Cities are designed such that it is characterized to be economically self-sustaining with innovative productivity and flexible labour market, well linked communication routes, good means of transportation, the development and diversification of the commercial activities, plus the opportunity of creating new jobs, which ensures raising incomes and the development of individuals. Government also participates in decision-making, offering public, social services and putting together political strategies plans for development of social, economic and environmental sustainability.

The urbanization process of towns in the community in Awka and Onitsha in general being a fast-growing city and its horizontal expansion in particular resulted in many challenges. These challenges are serious and multidimensional. The urban expansion caused several challenges on the livelihood of the farming community and nearby communities surrounding the local government. Even though urbanization brought opportunities in the area, it also has posed several challenges which include environmental degradation (soil erosion), flooding and poor waste management system. It is also faced with insecurity, traffic congestion, improper town planning, congested land use, etc. Among them all is the effect of GHG to the residents due to climate change which has being caused by urban sprawl in the conversion of vegetative land to build up areas and the erection of industries which introduces carbon to the atmosphere (Ogunbodede *et al.,* 2013). Urbanization creates multiple options for economic elites, but it hurts the poor majority. This trend is very tangible in the study area. But, it was

not rigorously investigated. Urban sprawl increases land conversion into urban use for different purposes. This reduced agricultural lands and exposed farmers to new socio-economic prospects and challenges.

Urbanization is on the increase, and has become very rapid in recent years due to technological advancement, social and economic activities in the Nigerian cities (Gezahegen, 2013; Aderiyan, 2007). This has posed most of the rural dwellers to run to the cities in search of regularly paid jobs without taking into consideration the consequences of urban stretch and improper planning for the incoming dwellers, thereby over stressing the social amenities and infrastructural facilities. The community lacks modern technical skills such as business knowledge and entrepreneurship skills which aggravate the severity of urbanization challenges on the community. This indicates the existing urbanization trend does not harmonize with the interest of the community.

Onwuka *et al*. (2017) analysed land use/cover dynamics in Onitsha metropolis and result indicates that urbanization is on the increase due to the commercial activities in the area. The study area is expected to face several complicated and tremendous challenges unless the impacts are identified and controlled before escalation. The problems become more severe due to industrial establishments that take huge land size. The vast area of farmlands is nowadays taken over by industries which consume more land. These industrial establishments increase land dispossession and eviction of farmers from their land. The detail of these challenges was not critically studied. So this research will be conducted to address this gap. The open spaces in the vicinity of the towns surrounding, the community in Awka and Onitsha are highly converted to other use without considering the present community's needs and the coming generation's fate. For this reason, the community in Awka and Onitsha becomes exposed to unfamiliar challenges which need meticulous investigation. Hence, this study

considered the socio-economic challenges of urbanization on the community in Awka and Onitsha in order to disclose the realities regarding the impact of urban expansion.

This study will investigate the spatio-temporal patterns of Awka and Onitsha urban growth over the years (1988, 2003 and 2018) and attempt to predict future urbanization; its socio-economic impacts, and identify appropriate measures of sustainability of Awka and Onitsha, Anambra state. Remote sensing and GIS as a tool will be used to accomplish this task which is believed to lead to new levels of understanding of urban development process which can assist city planners and policy makers to make informed decision.

1.3 Justification for the study

Awka is fast developing being the state capital of Anambra state, people within and all around the state comes to Awka for administrative or commercial purposes for search of job opportunities or good living. Also is Onitsha, a well-known center for businesses and commercial activities. People from neighbouring states across the country tend to move into the area for pursuit of business and commercial activities. These have resulted to the population growth in these areas leading to urban growth. This study is of importance as the outcome would assist in policy and performance improvement, and add to the existing body of knowledge in making the study areas sustainable. These are explained below

1.3.1 Policy Improvement

Although urban growth is an inescapable process, efforts can be made to, reduce natural hazards such as flooding and improve the livelihoods of urban dwellers through proper way of urban planning and management. To do so, city planners, policy makers and resource managers need more advanced and quick techniques to acquire quantitative

information on urban growth process and patterns. It can facilitate the urgent establishment of management mechanisms and relevant policy interventions for proper allocation of resources and urban infrastructures based on empirical evidences. However, the available information on the city growth and evolution is insufficient and outdated. This makes decision making process complex and less transparent. Therefore, quantifying urban growth processes and patterns is crucial to monitor urbanization and its impact on environment over time. However, this give information about spatial patterns of urbanization processes that characterize urban areas which will benefit policy makers in the ministry of land and housing (MLH) and ministry of environment (MEM) in the formulation, execution and monitoring of policies towards sustainability.

1.3.2 Performance improvement

Over the years, problems of spatial changes which occurred in different ways in Anambra state, have affected environmental development of the area. The outdated nature of topographical map and the general lack of urban land use map in Nigeria, which are planning and monitoring tools, informed the need for this study. The technology that provides a proper means of monitoring land cover and land use changes and the spatial expansion of cities is satellite remote sensing and Geographic Information System (GIS). It is against this background that this research applies the use of GIS and Remote Sensing to determine the spatial expansion of Awka and Onitsha respectively and its implications on urban environment. There is no doubt that development has brought about spatial changes in the land use in the areas, and this has led to tremendous loss of vegetal cover, agricultural land, green spaces and other natural resources within and the out sketch of the cities. So, this study will improve the management of the Ministry of Land and Housing (MLH), and Ministry of Environment (MEM) towards proper management of the environment towards a better sustainability.

1.3.3 Body of knowledge

This study will serve as a useful reference material for individuals and organizations in the works department sector in the ministry of land and housing (MLH), and ministry of environment (MEM). Also, the general public could find it useful in extending the limits of knowledge in urban growth and its impacts.

1.4 Scope of the Study

The study covers the spatial land use changes within the study areas. It focused on changes in urban growth. It also assessed the settlement growth pattern as well as the physical development and urbanization trend that emerged within Awka and Onitsha of Anambra state between 1988 to 2018 using satellite imagery, and trend analysis.

In terms of spatial scope, this study will be focused on Awka and Onitsha. These areas were selected because they are areas that are fast developing because of the commercial activities being carried out in them. These are areas were the population is rapidly increasing for search for healthy living. The entire area that makes up the city will be taken into consideration in order to ascertain the effect of urbanization on the populace.

The content of this study will be limited to the spatio-temporal change in land use and land cover change and the socio-economic impacts of urbanization to the residents of Awka and Onitsha respectively. This is because those residing in Awka and Onitsha are the once who can vividly give an account of the situation at hand.

1.5 Aim and Objectives

The aim of this study was to conduct a comparative study of urban expansion and its socio-economic impact on Awka and Onitsha, Anambra state, Nigeria.

In order to achieve this aim, the following objectives were pursued, to:

i. Examine changes in Land Use and Land Cover in Awka and Onitsha between 1988, 2003 and 2018.
ii. Predict urbanization trend of Awka and Onitsha from 2018 to 2030.
iii. Examine the socio-economic impact of urbanization in the two study areas.
iv. Identify appropriate measures for sustainable growth and development of Awka and Onitsha.

1.6 Research Questions

i. What are the changes in Land Use and Land Cover in Awka and Onitsha of Anambra state Nigeria between 1988, 2003 and 2018?
ii. How will the urbanization trend in Awka and Onitsha in the coming decade look like?
iii. What are the socio-economic effects of urbanization in activities of Awka and Onitsha?
iv. What are the measures for sustainability of urbanization in Awka and Onitsha of Anambra state, Nigeria?

1.7 Description of Study Area

1.7.1 Awka

1.7.1.1 Location and regional setting

Awka, located between longitude 7° 4'East and latitude 6°12'N, is the capital of Anambra State, one of the 36 States of the Federation and one of the five States in the South-East geo-political zone of the country. The other states are Abia, Ebonyi, Enugu and Imo. Awka Capital Territory, occupying the middle of the eastern boarder of Anambra state, lies due west of the Mamu River which forms its eastern boundary (Onwuka *et al*., 2017).

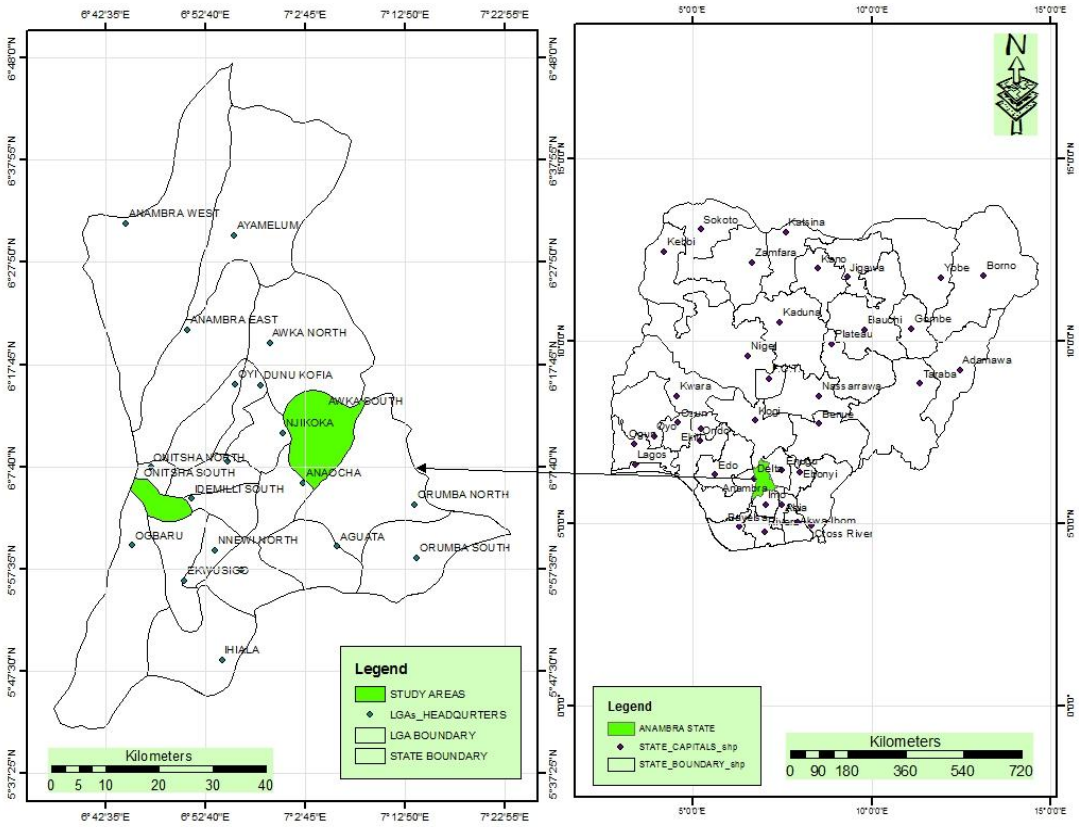

Figure 1.1: Administrative map of Nigeria showing Anambra State and the location of Awka and Onitsha.

The land area of the capital territory covers 10km radius and could be regarded as a heavily populated sub region, with Awka occupying the centre at the junction of the old Enugu- Onitsha road and Amawbia –Orlu road. This sub-region encircles many fast growing small and medium towns which include Awka, Amawbia, Nibo, Nise, part of Agulu, part of Awgbu, Mbaukwu, Umuawulu, Ezinato, Isu- Aniocha, and part of Amansea, Okpuno, Mbaukwu, Urum, and Nawgu. Others are Enugwu- ukwu, part of Nimo, Nawfia, Nri and Adazi- Nnukwu. The Sub-region covers six Local Governments which include Awka Capital Territory, Awka South Local Government area accounting for more than half of the land area. Others are Awka North, Njikoka, Anaocha, Dunukofia and Orumba local Government Areas Urban growth has been rapid in the area. The three towns of Awka, Amawbia and Okpuno have grown to merge with each other, forming a conurbation. For the purposes of this urban structure plan project, the three towns constitute the urban core meant for more detailed proposals (Onwuka *et al*., 2017).

1.7.1.2 Climate and temperature

The area under discussion lies within the tropical wet climate zone with clear-cut wet and dry seasons. Nearly eight out of the twelve months of the year enjoy the rains while the four remaining months fall within the dry season. These two seasons are brought about by the two predominant winds that rule the area: the south western monsoon winds from the Atlantic Ocean and the North eastern dry winds from across the Sahara dessert. The harmattan – a particularly dry and dusty period occurs for about two weeks within dry season usually between November and February (Onwuka *et al*., 2017).

Awka experiences high temperatures in the range of (27-28˚ C), which increase to a peak of about 35˚ C between February and April, the hottest period. The coolest periods

occur from mid-July through December to early January, coinciding with middle of the rainy season and the harmattan respectively. Awka's high temperatures creating warm condition have great potentials for promoting outdoor recreational pursuits and tourism. High humidity and rainfall characterize the Awka region. These produce considerable discomfort. Between 1979 and 1989, the mean annual rainfall recorded was 1,485.2 mm with, mean monthly figure of 50mm. An absolute daily maximum of over 200mm has been recorded between June and August in the area (Onwuka *et al*., 2017).

1.7.1.3 Topography

Most of the Territory lies below 300 metres above sea level on the plains of the Mamu River. This portion is fairly level and tilts very gently towards the Mamu. Two ridges or cuestas, both lying in a North-South direction, form the major topographical features of the area. The ridges reach the highest point at Agulu outside the Capital Territory. About six kilometers east of this, the minor cuesta peaks about 150 metres above sea level at Ifite –Awka. The valley or plain surrounding this portion hosts the Awka, Amawbia, Umuokpu, Nibo, Mbaukwu and Umuawulu towns (Onwuka *et al*., 2017).

1.7.1.4 Geology and soils

A thick sequence of shale and sand stones formed in the Paleocene age underlie most of the Territory. Eocene fossils are also common; a rich bed of sands and clay containing seams of lignite cover these strata. Quaternary sediments predominate, in Anambra State. The soil types are three, viz: loamy, clay and fine white sands, and lateritic, red to brownish soil, poorly cemented and with moderate permeability. It is easily eroded (Onwuka *et al*., 2017).

1.7.1.5 Vegetation

Awka Sub-region falls within the rain forest zone of Nigeria. But pressure on land in form of agriculture and commerce has largely reduced the vegetation here to mixed savanna. Only along stream courses and in few preserved areas can one find some rain forest trees such as Iroko, soft wood, domesticated species like oranges, mangoes etc. Palm trees/ coconut trees are quite common in residential areas for their economic value. However, the predominant vegetation here is mixed savanna. The wetter river valleys support dense rainforest. Rain forest of evergreen vegetation abounds along streams (Onwuka *et al*., 2017).

1.7.2 Onitsha

1.7.2.1 Location and regional settings

Onitsha, the gateway to eastern Nigeria and economic nerve centre of Nigeria, is located on longitude 6˚ 47'E and latitude 6˚ 09'N in the Anambra North Senatorial Zone of Anambra State. It occupies the eastern bank of River Niger, covering some 50 square kilometers.

Onitsha is strategically located and accessed through the east – west national main road from Lagos through Benin which links the eastern north – south route via the Niger Bridge at Onitsha. The main concentration of population and industrial activity and the areas showing the greatest potential for growth are situated along this transportation axis. The recent process of urban expansion very largely reflects the communication network. Her location which combines both road and waterway access points, makes it to be one of the four main potential industrial and commercial growth areas in Nigeria.

The city is split up into two Local Government areas namely, Onitsha South and Onitsha North Local Government Areas. Onitsha North and South Local Government Areas are bounded by Ogbaru Local Government to the south, Idemili North and Oyi Local Governments to the east and Anambra East Local Government to the North (Onwuka *et al*., 2017).

1.7.2.2 Geology, relief and drainage

Geologically, Onitsha and its neighbouring towns are situated within the vast sedimentary basin of the Niger-Benin trough of the upper middle Eocene known as the Bende Ameke group. Within this area, there are large areas of alluvium from the quaternary period.

Topographically the Planning Area is traversed and drained mainly by River Niger and its many tributaries, notably rivers Anambra (which lends the State its name), Nkissi and Idemili Rivers, all draining into the Niger. The Anambra River is the largest of all the tributaries to the Niger south of Lokoja, the confluence of River Benue with the Niger. The geology of the area is of the Orlu cuesta formation which terminates at the River Niger bank. This upland area, which varies between 150 and 240m in height, is dissected by a number of small streams draining into River Niger (Onwuka *et al*., 2017).

1.7.2.3 Climate and Temperature

Onitsha and its neighboring towns are located in the transition area between the sub-equatorial climatic and the tropical hinterland climatic belts of Nigeria. The climate here is influenced by two major trade winds: the warm moist Southwest Trade Winds during the rainy season (April – October) and the North East Trade Winds during the dry and dusty harmattan (November- March) (Onwuka *et al*., 2017).

In Onitsha, temperature is generally high (Maximum monthly temperatures varying from 78˚ F and 81˚ F. Mean temperatures are relatively constant throughout the year at about 770F with maximum temperatures experienced in the December – March period and minimum between June – September period (Onwuka *et al*., 2017).

Annual rainfall averages about 1,850mm (74 inches) per annum, which is reasonably high. Most of the rains fall between mid-March and mid - November although infrequently, there could be rains during the dry season. Precipitation in the dry season is mainly in form of dew. This is generally high throughout the year, with figures between 70% and 80%. Highest figures for relative humidity are experienced during the wet season and the lowest during the dry (Onwuka *et al*., 2017).

1.7.2.4 Vegetation

The vegetation within this region is light forest interspersed in some cases with tall grasses. The trees are not too tall, and domesticated or economic trees such as the mango, palm tree, guava, orange, almond etc. are found. Some of the trees are hard while others are soft. Many of the trees of the natural vegetation have been felled and the land utilized for development (Onwuka *et al*., 2017).

1.7.2.5 Soils

The soils around Onitsha and indeed on the banks of the River Niger are characterized by a wide plain of alluvium. There are also sandy and loamy soils around the Nkpor and Ogidi area of the region (Onwuka *et al*., 2017).

1.8 Historical Background of Awka

The first settlers in Awka and sub-region migrated originated from Avomimi village in Enugwu-ukwu from about AD 900. They associated their origins and mythology with

the Nri people who established Nri Kingdom and hegemony in pre-colonial times. History had it that Awka was the centre of the Nri Kingdom. Other surrounding towns namely, Agulu, Agukwu- Nri, Enugwu-Ukwu, Enugwu-Agidi and Nawfia call themselves Umu-Nri. Adazi and Mbaukwu also claim Nri lineage.

Awka was believed to occupy the site between the present village of Amudo and Ifite, a favorable flat fertile agricultural land. The Nri developed their divine kingship and established a kingdom and hegemony, not by conquest, but by control of the ritual life of the people, control of Ozo and Eze titles, control of yam cult, and so on. The hegemony embraced much of Igbo land east and west of the River Niger. At that time, Awka people, especially those from Agulu Quarter, Umuzuocha and Umunagu wards were broadening their economic base by engaging in various kinds of crafts activities particularly, black smiting, wood carving, ivory carving, and art work; and others engaging in other non- agricultural activities like herbal healing and trade. The blacksmith developed the apprenticeship system where they groomed the younger ones in their trade purposely to ensure succession.

Several smiths traveled out or even migrated to other settlements in order to get a wider range of clientele and increase their sales. With time, Awka smiths became widely renowned. They made numerous implements such as Otonsi (staff of peace), Oji (staff of mystical power), Ngwuagiliga (staff of ozo men), and metal bells; musical instruments like iron gongs and also, Alo (the big ogene); and war implements namely spear, dagger, and later, Dane guns.

The people of Umudioka and Ezioka wards specialized in carving of wood, and ivory and arts designs. The wood carvers among them produced elegantly carved tools, door shutters and door panels, chairs, vessels for presentation of kola nuts, and idols (Okpesi).

The ivory carvers produced elegant designs on “odu okike” (ivory trumpet) for ozo titled men and other items as part of the paraphernalia for titled men.

The artists among them produced various elaborate designs made on pots and wooden doors and engaged in paint works on walls of houses and compound. They also made the special “itchi” marks on faces of people intending to take titles.

The people of Amikwo Umuike, and Umuoruka wards also practice herbal medicine men, healing the sick and traded in ritual objects. They traveled widely advertising and selling their goods which included some of the products of the craftsmen. They sometimes acted as agents of Eze Nri, which conferred on them immunity from molestation as they went from place to place. Some of the Amikwos established Agbala oracle. A number of Aro migrants settled with the Amikwos and helped them run the Agbala oracle in the fashion of the long Juju of Arochukwu. The oracle soon became famous in the areas around and it fostered slave trading activities. Some Awka people became long distance traders, trading in various goods including slaves, ritual objects, and products of craftsmen. Their trading activity was promoted by Awka which was the Aro trade route to the Niger and west of the Niger.

With the increasing number of these nonagricultural specialists, Awka gradually developed into a pre-industrial urban centre both by natural increase and by immigration (there was of course some outmigration of some of the craftsmen, even if it was temporary migration). By 1850, the population of Awka\ was estimated at 18,000. This compared very favorably with the population of some other pre-industrial urban centres in the area that came to be known as Nigeria; for about the same year the population of Benin was established at 15,000 by Adams, Katsina at 8,000 in 1855 by Barth, Lagos

20,000 in 1856 by Brown, Onitsha, 15,000 in 1850 by Burdo, and Ondo 15,000 in 1883 by Chausse.

Before the creation of Anambra State in August 1991 with Awka as its Capital, the town had played different roles as administrative/zonal headquarters to different Governments. In these roles the city had remained more rural than urban in scope and essence. This had to change as soon as it became a State Capital.

The influx of population made up mainly of returnee civil servants from Enugu, employees of federal ministries and parastatals, student population of Nnamdi Azikiwe University and others, brought tremendous pressures on existing infrastructure and services (UN-HABITAT, 2009).

1.8.1 Brief ethnographic setting of Onitsha

The history of Onitsha is still a subject of controversy. Onitsha was said to be a 17th century village created by a group of migrants who moved away from a part of the disintegrating Benin empire, and in the course of this migration which took years, the Onitsha people settled at the eastern bank of the River Niger.

The name Onitsha means dispersal it reflects the manner the emigrants dealt with obstacles placed on their routes by adjoining towns and villages. Meanwhile, as the March pushed towards the river Niger, some of the emigrants who grew wearing decided to discontinue the journey and seek permanent places of settlement since it was undertaken on foot. The migration from Benin was said to have taken place between 1504 and 1550. However, there are two versions of the incident that led to the exodus of Onitsha people.

The first version was told of how Esigie, the mother of the Oba of Benin, on a certain day wandered into the farmland of Onitsha people in search of fire wood. The farmers took objection to what they considered a trespass and therefore beat her mercilessly. When the

woman returned home, she reported the incident to the Oba, who became infuriated and ordered his warriors to punish and drive the farmers away, so the exit of Onitsha people from Benin was precipitated.

The second version was based on the death of a great chief whose position was hereditary. During his funeral, a quarrel ensured between two factions of the family as to which of them would bury the chief and by custom, inherit is title. However, the matter reached a point where arbitrators, on the advice of the Oba, placed two coffins side by side; each purported to contain the corpse of the late chief. One of the coffins was carved and highly decorated, while the other was plain and unattractive. The stronger faction hastily carried away the decorated coffin for burial, only to be dismayed at the graveside, to find that it contained a log of wood. But before their discovery, their rivals had carried away the second coffin and to their amazement and joy found the remains of the deceased chief in it. They hurriedly buried him and inherited the chieftaincy title.

However, the disappointed side refused to accept the verdict and therefore left their fatherland for good after a fight, in search of a new settlement. The exodus involved ten villages. Their leader was a powerful man called Chima. There were many legends of the people's movement, but the basic cause of migration held by the indigenes was the clash between Chima and the Oba Esigie of Benin. After the departure from Benin, the emigrants travelled eastwards to the bank of the river Niger.

Their first place of call was Ozara Agogoro were they rested for some days. Latter they went to Agbor in Ika land. From Agbor, the group moved to Obior before setting at the permanent which is today known as Onitsha (UN-HABITAT, 2009).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

The concept related to this literature review is briefly discussed under this subsection. This includes; Urbanization, urbanization through the use of Remote sensing, urban land use and land cover, City.

2.1.1 Concept of urbanization

Urbanization is a world-wide phenomenon. It is a process of relative growth in a country's urban population accompanied by an even faster increase in the economic, political, and cultural importance of cities relative to rural areas. The term "urbanization" describes an increase in human habitation linked with increased per capita energy and resource consumption, and extensive landscape modification (McDonnell and Pickett, 1990). Since the population becomes more prosperous, demand for goods and services is often driven by more than just pure population growth. There is a worldwide trend toward urbanization. In most countries it is a natural consequence and stimulus of economic development based on industrialization and post industrialization.

The term urbanization as traditionally measured by demographers is urban population divided by total population of a region. Urbanization is also defined as the annual rate of change of the percentage of people living in urban areas, or the difference between the growth rate of urban population and that of total population. (NAAB, 2013).

Urbanization is a universal concept, signifying changes in man's interests, activities and values, and appearing to have been related to increasing functional specialization in

human societies. It has characteristics and processes of manifestations which differ from place to place given environmental, socio-cultural and political conditions peculiar to a particular geographical location. Thus, urban growth is a quantitative measure frequently associated with progress (Yichun *et al*., 2016).

Urbanization, which refers to the expansion in the proportion of a population living in urban areas, is one of the major social transformations sweeping the globe. It represents the movement of people from rural areas to urban areas with population growth equating to urban migration. It is generally believed that urbanization has both direct and indirect impacts on land use transformation. According to Ejaro and Umar (2013), Urban sprawl is one of the most noticeable effects of urbanization on land use. Though, sprawl can alter a regions unique rural character by creating miles of undifferentiated new developments that bring habitat loss along with traffic congestion. Rimal (2012) opined that urbanization is an inevitable process due to economic development and rapid population growth. Urbanization is a process of increase of modernization system which modifies the socioeconomic activities and revolutionizes the land use practice according to time frame (Ejaro and Umar, 2013).

From a demographic point of view, the level of urbanization is measured by the percentage of the population living in urban areas (Davis, 1962). In some cases, urbanization has strong relationship with level of economic development, in which developed countries have higher level of urbanization than in developing countries. Since the industrial revolution in the late 18th century, the urbanization process was led in England and then followed by many other countries.

The proportion of the world's population living in urban areas, which was less than 5 % in 1800 increased to 47% in 2000 and is expected to reach 65 % and 70% in 2030 and

2050 respectively; with Africa and Asia being projected as the regions that will experience the largest growth in urban populations (Harriet, 2011; Olaleye, 2013). In Nigeria, urbanization is mainly caused by urban growth, which could be due to natural population growth, reclassification of urban and rural system; and rural-urban migration. Previous studies and projections suggest that Nigerian urban population will reach 100 million by 2020, even though the urban population growth rate which was 5.7% in 1985, 5.8% in 2004 is now declining to the current rates of 4.0%, which is still far higher than Nigeria's overall population growth rate (Agbola, 2004; Olaleye, 2013). It is also evident that the rapid rate of urbanization in Nigeria and the consequential explosion of urban population have not been matched by a corresponding commensurate change in social, economic and technological development, resulting in nearly stagnant economy and negligible growth of industrialization (Olaleye, 2013).

Darin-Drabkin (1977) mentioned that the basic trends in world urbanization are: (1) An increasing percentage of world population is living in urban areas, the largest cities having the fastest growth; (2) Employment within these metropolitan areas is becoming concentrated in the city center; and (3) Population growth is mainly occurring in the outlying regions of the metropolitan area. Rapid population growth itself is a result of the diffusion of scientific-medical knowledge, and is the underlying cause of the growth of urban population. But the concentration of population in urban areas is also affected by economic growth, which is reducing the percentage of the population employed in agricultural (and rural) areas. Structural changes in employment, especially the raising of tertiary (service) sector have led to increased number of employment in the city center. Because most of the service firms need to be centrally located so they can obtain benefit from close interaction with each other. Industrial activities also continues to concentrate in the metropolitan area, which has a pool of skilled man-power, access to

consumer markets, and a variety of auxiliary commercial services. These structural changes have also had an impact on the distribution of population in the urban areas. The increasing role of the city center for commercial purposes forces population shift to outlying districts. Developing new transportation systems has allowed it a degree of dispersal within the metropolitan region and facilitates outward spreading of urban areas.

2.1.2 Concept of a city

Cities have important role on global development. Cities are complex human systems and serve as magnets for people, enterprise and culture (Singh, 2014). Cities generally have complex systems for sanitation, utilities, land usage, housing, and transportation. The concentration of development greatly facilities interaction between people and businesses, benefiting both parties in the process, but it also present challenges to managing urban growth.

A city can be defined by its administrative criteria or political boundaries within the jurisdiction of a municipality or town with population density of 2,000 people. This varies globally between 200 and 50,000, economic function where significant majorities of the population do not primarily engage in agriculture, or where there is surplus employment with the presence of urban characteristics such as paved streets, electric lighting, sewerage among other (UN, 2000).

Cities are based on a number of different systems such as infrastructure, networks and environments, people, business, transport, communication, water, and energy. The effectiveness and efficiency of these systems determine how a city works and how successful it is at delivering its goals (UN-Habitat, 2003). Most countries use a single characteristic or a combination of administrative, population size or density, economic and urban characteristics to define a city.

Cities play increasing roles in infrastructural, economic change, poverty reduction and environmental development (Satterthwaite, 2010). The position of cities in the global economy varies as their window of opportunities for development. In developed countries, for example, there are cities offering good networks and benefits to the rest of the world. Infrastructural development however, remains the life wire of activity system of cities. Thus, adequate infrastructure and efficient city management helps to broaden the perspective of city dwellers and foreign investors; it enhances the quality of life of individual as well as the city as a whole.

There are several urban issues that usually occurred in the big cities, such as: urban sprawl; climate change and air pollution; urban waste management; water supply; inadequate energy; public health problems; pressure on natural habitats and so on (UN-Habitat, 2003). Singh (2014) mentioned that in traditional concept, the city is defined as a catalyst of economic growth. But recently the cities and urban development challenges not only focus on economic growth but also express concern about unsustainable development and its negative impacts of rapid urban development such as urban sprawl, deteriorating inner-city infrastructure, traffic congestion, environmental degradation and so on. A city is defined as a continuous urban built up with less than 200 m between construction, and bringing together more than 10,000 inhabitants. Cities occupy only 2% of the world's land but consume 75% of its resources and produce a similar percentage of its waste. They consume most of the fuel and electricity used by transport, industry, infrastructure, and household daily activity. Cities are major contributors to climate change since they contribute approximately 75% of the greenhouse gas (GHG) emissions (Singh, 2014). They generate significant environmental footprints, including contamination of air and water. Asian big cities like Delhi, Kolkata (Calcutta), Mumbai (Bombay), Dhaka, Karachi, Bangkok, Beijing, Shanghai, Jakarta, and Manila are

concerned to be one of the most polluted cities. Asia's projected global share of CO2 emissions for energy consumption will increase from 30 % in 2006 to 43% in 2030 (Singh, 2014). Rapid urbanization in Asian developing countries has been followed by excessive of the urban population concentration in very large urban agglomerations (megacities). Dispersed urban development in Asian developing countries has led to environmental degradation, increased energy consumption for transportation, serious problems of air and water pollution, traffic congestion, and another environmental problem (Singh, 2014; Sorensen *et al*., 2004).

2.1.3 The challenge of urbanization in Nigeria

the United Nations Fund for population Activities (UNEPA) during the 1999 world Habitat day confirmed that urban revolution has begun o which Africa and other developing countries would have to face great challenges and Nigeria is taking the lead, available report indicates that urban population has been growing at an alarming rate of about 47 percent as at 2003 (UN-Habitat, 2003), while most of the major cities expand without incorporating the major element of physical planning. Until recently, Nigeria did not have any regulatory codes or standard to guide planning of building and environment development. Consequently, the forces of urbanization and industrialization have brought about changes in production activities, thus resulting in explosive demographic changes with growth rates ranging between 6% and 12% per annum, this rate of urban growth and relative poverty that accompanies it poses a critical challenge to effective governance and sustainable development (Jiboye, 2005).

These has brought about various socio-economic, cultural and environment problems, particularly, degradation of the physical urban environment which exists in the nature of loss of biodiversity which in turn contribute to the climate change challenges and green-

house warming, desertification, degradation of agricultural land, air and water pollution, environmental decay, slums, insanitation, overcrowding, housing congestion, crime and violence, and several other demeaning situations (Omisore *et al*., 2003; Ogunleye, 2005; Daramola & Ibem, 2011). The following challenges are very clear in Nigeria cities;

2.1.3.1 The unrestrained rural-urban migration

Most urban cities in Igbo land face the emasculating challenge of unrestrained rural-urban migration. Many people from the rural communities migrate to urban centers not necessarily that there are available jobs in the urban centers for them, but for the joy of residing in urban cities. This has been attributed to the unfavorable environment in rural communities especially with the absence of modern infrastructural facilities or the decay of existing ones. The unrestrained rural-urban migration in Igbo land has given rise to the development of slums within the suburbs of cities which do not enjoy modern facilities. Onwuka *et al*. (2017) described Ogui Urban Area, a well-known slum in Enugu urban, as "an unpleasant slum". This was because it lacked modern infrastructural facilities such as good houses, health care centers, regular power supply, police station etc. and, above all, was reputed to be a haven for undesirable elements.

2.1.3.2 Crimes and security

The prevailing crimes in Nigeria urban centers include robbery, kidnapping, rape, murder, child trafficking, murder, political violence, fraud, suicide, and prostitution among other crimes, which are the resultant actors of urbanization. The Nigerian police numerical strength is not commensurate with the total population, as one policeman to 5,000Nigerians; unlike in developed countries with the total population to about 400 people (Agbola, 1997). Moreover, with the disproportion between the security strength and population in Nigeria, study shows that in Nigeria urban centers, a number of army

soldiers and police officers have been sentenced to death for armed robbery involvement in Nigeria urban centers. Criminal activities and violence are assuming dangerous tendencies as they threaten lives and properties, the national sense of well-being and coherence, peace, social order and security, thus, reducing the quality of life of the citizens (Ahmed, 2010). At least, one of these crimes is contained on daily basis in Nigerian urban centre, while in some cases the culprits are always at large.

2.1.3.3 Housing congestion

Many researchers have described the conditions of the housing where over 60% of urban dwellers live in Nigeria is highly deplorable (Olotuah and Adesiji, 2005). High rates of overcrowding, substandard buildings, and infrastructural inadequacies have been reported in all the urban centers in Nigeria (Onibokun, 1987). Over 75% of the dwelling units in Nigeria's urban centers are substandard and the dwellings are sited in slums. Thus, over 60% of the urban dwellers live in slums characterized with over-crowding, poor sanitary conditions, lack or inadequate basic facilities and amenities, crimes and poverty among other things. While some urban dwellers still struggle to live in deplorable slums that are nothing but objects of visual pollutants to the western world, some are even homeless thereby sleeping around in different abandoned vehicles and buildings, under bridges, in stores and so on.

2.1.3.4 Poverty

World Bank (1996) defines poverty as hunger, lack of shelter, being sick and not being able to see a doctor, not having access to school and not knowing how to read. Aluko (1975) refers to poverty as a lack of command over basic consumption needs. Poverty is also having fear for tomorrow, the state of hopelessness and to be jobless. Nigeria is among the countries working to achieve the eight (8) Millennium Development goals

(MDGs) by 2015. It is not a surprise for the president of Nigeria to declare in a live broadcast in mid-July of 2013, that Nigeria may not achieve any of the MDGs by 2015. The second MDGs, is to eradicate the extreme poverty and hunger. More than 70 million Nigerians live in poverty (Ayedun, *et al.,* 2011). Poverty is high in Nigeria due to the inadequate job opportunities, infrastructural facilities and services that do not meet demands of urban populace. The depth of poverty declined from 19% to 16% in the rural areas, while it increased in urban areas from 9% to 12%. In 1985-1992, total extreme poverty in Nigeria increased from 10.1 million people to 13.9 million with a near three-fold increase in the urban extreme poor from 1.5million to 4.3 million people (World Bank, 1995).

2.1.3.5 Environmental problems

One of the most critical issues brought by urbanization in Nigeria Urban centers are environmental problems. In Nigeria, Mba, (2004) identifies several types of environmental problems classified as ecological, poaching and habitat loss, increasing desertification and soil erosion. These are further subdivided into pollution (water, land, visual and noise), deforestation, global warming and slum development, etc. Nigeria's coastal regions are currently experiencing widespread contamination from petroleum exploration (gas flaring, oil spillage) while the general poor living conditions in urban areas in the country constitutes an affront to human dignity (Adedeji and Ezeyi, 2010).improper wastes management has made the societal fabric of many urban centers in Nigeria to be very unsightly. Traffic congestion which increases the generation of the cars exhaust due to the traffic delay is another major environmental problem in Nigeria urban centers. Slum developments in urban centers also deplete the physical environmental, increases crimes and violence. The environmental problems are seen as the results of human activities which are higher in the urban centers.

2.1.3.6 Climate change

Man's activities relating to where he lives, works and his movement from place to place, consumption as well as the usage of technologies, all affect heat emission in a city (Olaleye, 2013). According to Odjugo (2011), Nigeria is experiencing global warming at the rate higher than the global mean temperatures. In Nigeria, the mean increase in temperature from 1971 to 2008 is 1.78 ℃, compared to the global mean increase in temperature of 0.74 ˚C since instrumental global temperature measurement started in 1860 (Odjugo, 2011). The sharp increase in temperature between 1971 and 2005 in Nigeria could be linked to the effect of climate change and its associated global warming earlier reported (Mabo, 2006 and Odjugo, 2011). Climate change results to the incessant flood occurrence, harsh temperature, poor agricultural activities, and human health diseases (skin reactions and respiratory diseases) among other challenges.

2.1.3.7 Unemployment

One of the major consequences of the rapid urbanization process has been the burgeoning supply of job seekers in both the modern (formal) and traditional (informal) sectors of the urban economy (Todaro, 1997). Rural-urban migration has a significant impact on unemployment levels of the destination cities (Aworemi and Joshua, 2011). Between 1998 and 1999, urban unemployment rose from 5.5% to 6.5%, a rate higher than the national unemployment which increased from 3.9% to 4.7& during the same period (USAID, 2002). Unemployment is a very high in all urban centers in Nigeria, and the main reason is because of the high population of migrants from the rural areas in Nigeria and few other national migrants from other African countries that come to seek for jobs that are not available in the urban centers. As the unemployment rate in

increasing in the urban centers, it is reducing in country side because of the homogenous type of activity in the countryside which is agriculture.

In other to achieve the objective of this study, challenges of urbanization in Nigeria will be put into consideration as to maintain sustainability of the Awka and Onitsha.

2.1.4 Understanding urbanization through the use of Remote sensing

Remote sensing nowadays has become a modern tool for mapping and analysis of land use and land cover for micro, meso, and macro level planning. Remote sensing systems have the capability for repetitive coverage, which is required for change detection studies. For ensuring planned development and monitoring the land utilization pattern of land use and land cover map necessary.

Sensors operating in the visible and infrared portion of the spectrum are the most useful data sources for land use analysis. While many urban features can be detected on radar and other imagery (usually because of high reflectivity), VIR data at high resolution permits fine distinction of the urban fringe and the transition to rural land usage. Optical imagery acquired during winter months is also useful for roughly delineating urban areas and nonurban. Cities appear in dramatic contrast to smooth textured snow-covered fields.

With multi-temporal analysis, remote sensing gives a unique perspective of how cities evolve. The key element for mapping rural to urban land use change is the ability to discriminate between rural uses (farming, pasture forests) and urban use (residential, commercial, and recreational). Remote sensing methods can be employed to classify types of land use in a practical, economical and repetitive fashion, over large areas. Satellite images can be used to detect the spatiotemporal changes, these provides spatially consistent coverage of large areas with both high spatial detail and temporal

frequency, which is useful for examining historical time series. Therefore, with increased availability and improved multi-spatial and multi-temporal resolution, remote sensing can be applied to monitor and analyze urban expansion and land use changes in a timely and cost-effective manner.

Throughout the world, requirements for rural/urban delineation will differ according to the prevalent atmospheric conditions. Areas with frequently cloudy skies may require the penetrating ability of radar, while areas with clear conditions can use air-photo, optical satellite or radar data. While the land use practices for both rural and urban areas will be significantly different in various parts of the world, the requirement for remote sensing techniques to be applied (other than the cloud-cover issue) will be primarily the need for fine spatial detail.

The change in the land use from rural to urban is monitored to estimate populations, predict and plan direction of urban sprawl for developers, and monitor adjacent environmentally sensitive areas or hazards. Temporary refugee settlements and tent cities can be monitored and population amounts and densities estimated. The combination of remote sensing and Geographic information system (GIS) can provide spatially consistent and detailed information about urban service structure, permitting more accurate representation and understanding of urban growth processes (Deng *et al.,* 2009). Landscape ecology offers theories and methods that can contribute to the formulation of sustainability strategies through a better understanding of land structure. Remote sensing has already proved useful in mapping urban areas and as data source for the analysis and modeling of urban growth and land cover change land scope transformation processes spatial characteristics of landscape pattern through time, and this is why the idea and aim of this work is been conceived to assess the changes in

previously segregated urban settlement in Awka and Onitsha using remote sensing technique.

2.1.5 Urbanization and urban growth in sub –Saharan Africa

Definitions of urban and rural vary widely across Africa. Almost half the countries in Africa use a numerical definition to indicate the areas that qualify as urban. Many Sub-Saharan African countries use a population figure of 2,000 to distinguish between rural and urban settlements. However, the figure varies from 100 in Uganda to 20,000 in Nigeria and Mauritius (UN, 1999). For example, in Uganda the definition of urban areas has been changing over time. The 2002 Census defined urban areas as gazette cities, municipalities and town councils as per the Local Government Act 2000, while the earlier censuses included un-gazette trading centers with more than 1,000 people as part of the urban population. The pattern of urbanization in West Africa differs somewhat from that in East Africa. In many West African countries there are few secondary cities, so the population is concentrated in one or a few large cities.

Population growth in East Africa is more evenly distributed over secondary and tertiary cities. But, primary cities are going through a period of rapid growth (UN-Habitat, 2009). The most important contributor to urbanization in both West and East Africa was until recently migration from rural areas. In Southern Africa natural population increase is already the most predominant cause of urbanization. Global economic processes have slowed down Sub- Saharan Africa with severe consequences for its urban areas.

Africa is the only region of the world without a true newly industrializing economy. The failure to industrialize can partly be explained by external factors, but a variety of domestic factors must also be taken into account, including economic policies, the

effects of personal rule, historical legacy, and the role of the state and low levels of literacy (UN, 1999).

2.1.6 Land cover change

Human intervention and natural processes are responsible for the constant change in land cover all over the world. Land cover change is determined by the interaction in space and time between biophysical and human influences. Urbanization is a rapid land cover change process that produces different patterns depending on the proximity to large urban centers across the landscape (Wu, 2004). Many land cover change models have been used to identify the drivers assumed to affect conversions of land between built up and non-built up land cover categories. Information about urbanization, obtained from multiple multi-temporal images, can provide valuable knowledge about the patterns of urban growth and the probable factors driving the changes. This information is important for planners, policy makers and resource managers to make informed decisions. Nowadays decision makers are becoming more and more dependent on models of land use/cover change (Veldkamp and Verburg, 2004). Description and modelling of land systems is highly dependent on the availability and quality data (Tayyebi *et al*., 2010). The spatial dependency of land cover changes can be analysed by the integration of remote sensing and GIS techniques. These techniques have an efficient spatial capability to monitor urban expansion in urban areas.

Monitoring and analyzing of the urban environment make use up-to-date Land use and Land cover (LULC) information, for proficient and sustainable management of urban areas. Land use and land cover is a key driver of global change and has significant implications for many international policy issues (Nunes and Auge, 1999). In particular, change in land cover in the way people use the land have become recognized over the

last 15 years as important global environmental changes in their own right (Tuner, 2002). To understand how LULC change affects and interacts with global earth systems, information is needed on what changes occur, where and when they occur, the rates at which they occur, and the social and physical forces that drive those changes (Lambin, 1997). The information needs for such a synthesis are diverse. Remote sensing has an important contribution to make in documenting the actual change in land use/land cover on regional and global scales.

However, the advent of air-and space-borne remote sensing has made it possible to acquire pre-and post-project land use and land cover in consistent manner. In addition, the advent of geographic information system (GIS) has made it possible to integrate multisource and multidate data for the generation of land use and land cover changes involving such information as the trend, rate, nature, location and magnitude of the changes (Adeniyi and Omojola 1999). Requirements for rural – urban change detection and mapping applications includes: high resolution to obtain detailed information and multispectral optical data to make fine distinction among various land use classes. Radar sensor also have some use for all urban/rural delineation applications, due to the ability of the imaging geometry to enhance anthropogenic features, such as buildings, in the manner of corner reflectors. The optimum geometric arrangement between the sensor and urban area is an orientation of linear features parallel to the sensor movement, perpendicular to the incoming incident EM energy.

2.1.7 Remote sensing and urban growth

Urban growth is a characteristic of spatial changes that take place in metropolitan areas (Aguilera *et al*., 2011). The spatial configuration and the dynamics of urban growth are important topics of analysis in the contemporary urban studies (Bhatta, 2012). Several

methods and techniques have been developed and applied to quantify and characterize the urban growth processes and patterns. Traditionally, visual interpretations of high-resolution aerial photographs were used to acquire comprehensive information for mapping of urban growth. However, with the gradual possibilities of monitoring urban problems with a better accuracy have become more promising increasingly important at the global level (Guindon and Zhang, 2009).

Nowadays, there are several remote sensing satellite systems such as Landsat (TM &ETM+), ASTER, IKONOS, GeoEye, Quick bird, WorldView providing from medium to high and very high resolution imagery. It is also believed that remote sensing imagery is a powerful tool for acquiring data to analyse and map spatio- temporal land use change and urban growth process at different spatial scale (Yang and Lo, 2002; Yu *et al.,* 2011). Particularly, in developing countries, remote sensing may provide fundamental observations of urban growth and environmental conditions that are not available from other sources (Miller and Small, 2003).

Many scientists, resource managers, and planners agree that, the future development and management of urban areas entail comprehensive knowledge about the on-going processes and patterns. As a result, understanding the urban growth patterns, dynamic processes, and their relationships and interactions is a key objective in the contemporary urban studies (e.g. Bhatta, 2009, 2010; Deng *et al*., 2009). Remote sensing is helpful tool to better understand the spatiotemporal trends of urbanization and monitor the spatial pattern of urban landscape compared to traditional socioeconomic indicators such as population growth, employment shifts, etc. (Jun *et al*., 2009). However, the availability of multi-temporal data is important to analyse the dynamics of land cover change over time and space. In order to detect the changes and patterns of different spatial phenomenon, it is important to make sure that the available images are acquired

in the same season. This will help to avoid data inaccuracy generated due to seasonal variations. Nonetheless, it is difficult to find multi-date data taken at the same time of different years, particularly in tropical regions where cloud cover is prevalent (Mas, 1999). As a result the selection of temporal dimension is mostly dependent on the availability of good quality data at that particular time of interest. Particularly, this is true for developing countries.

Although challenged by different factors such as spatial and spectral heterogeneity of urban environments, remote sensing is an appropriate source of data for urban studies. According to a report published by NASA, the advances in satellite-based land surface mapping are contributing to an improved understanding of the underlying forces of urban growth and sprawl, as well as issues relating to territorial management. Nowadays, the physical expansions and patterns of urban growth on landscapes can be distinguished, mapped, and analysed by using remote sensing data (Bhatta, 2010). Medium resolution Landsat images play the key role in the analysis of urban change at different spatial scale (Buyantuyev *et al*., 2010; Ding *et al*., 2007)

Different studies have been conducted on urban change using medium resolution Landsat images. For instance, Yuan *et al.* (2005) used multi temporal Landsat images to analyse urban growth pattern and to monitor land cover changes of two twin cities in Minnesota metropolitan area. The result shows that it has been possible to quantify the land cover change patterns in the metropolitan area and demonstrate the potential of multi temporal Landsat data to provide an accurate and economical means to map and analyse changes in land cover over time. Yang and Lo (2002) used multi-temporal/multi-resolution satellite imageries to successfully extracted land use/cover data in the Atlanta, Georgia metropolitan area for the past 25 years. The result revealed that the loss of forest and urban sprawl have the major consequences of Atlanta‘s

accelerated urban development. Tang *et al*. (2008) used multi temporal satellite images to analyse the dynamics of urban landscape in two petroleum-based cities: Houston, Texas in the United States and Daqing, Heilongjiang province in China. Accordingly, both cities expanded rapidly on the basis of the petroleum industries during the study period; however, under varying socio-political settings.

2.2 Theoretical Framework

This study is relying heavily on three theories of urbanization which were; the Modernization Theory, the Dependency Theory and the Urban Bias Theory.

2.2.1 Modernization theory

According to Sogoti (2013), the Modernization theory was developed in the mid-20th century. Modernization is the term used for the transition from the traditional society of the past to modern society as found in the west. Modernization theory presents the idea that by introducing modern methods of production – like the use of advanced technology of industry the under-developed countries will experience a strengthening in their economies and this will lead them to development. This theory holds that the modernization of states through economic development encourages other forms of development like social and political development. This theory focuses on economic development as operationalized variables such as GDP per capita.

According to the modernization school there cannot be urbanization without industrialization (Sogoti, 2013). In other words the more industrialized a society is the more urbanized it is.

In this study modernization and urbanization is thus underpinned on the modernization theory. With the emergence of urbanization the Awka and Onitsha community are seen

to adapt to new ways of life as way of strengthening their economic opportunities adopting a lifestyle that would be considered „modern" – away from the pastoral way of life.

2.2.2 Dependency theory

In views of the flaws of modernization theory and its inability to account for third world under-development, an alternative theory was devised by a group of scholars known as collectively as the dependency school which originated in Latin America this school holds that development in the developing countries is conditioned by the growth and expansion of Europe. It addresses certain issues not considered by modernization theory. It lays importance on historical processes in explaining the changes which have occurred in the structure of cities as a result of the switch from the pre-capitalist to capitalist mode of production. It also lays emphasis on the dependent nature of capitalist development in the third world which places emphasis on external economic forces in the study of cities. The dependency school argues that the developed countries use the developing countries as a source of input (raw materials supplier) for their factories. This results in foreign investment in large scale agricultural production which displaces peasant farmers in the rural areas. The displaced farmers then move to urban areas to seek employment (Sogoti, 2013).

In this study the „modernization" of the Awka is highly attributed to external forces that have led to the emergence of urban centers around and within Awka which in turn has an impact on their economic factor.

2.2.3 Urban bias theory

Another approach to understanding urban development in developing countries is through the application of urban bias theory. This theory shifts emphasis of urban

development from economic perspective to political perspective. This perspective by Sogoti (2013) argues that policies favor the urban areas to the detriment of the rural areas; hence the concentration of facilities and the creation of favorable conditions in the urban areas state politics allegedly overtax the rural citizens with similar incomes. The production of the rural areas notably agricultural product is overtaxed due to price twists. Overtaxing works in the following way. State controlled marketing boards buy agricultural products from the local farmers at an artificially low price and then resell these products to the consumers at the prevailing higher market price; the different is often used to provide facilities in the urban areas.

In addition, governments in the developing countries tend to invest domestic capital on the provision of development facilities. These facilities are largely located interurban areas while a larger proportion of the population is found in the rural areas. The facilities include hospitals, schools, libraries and other government/semi-government facilities. Investable resource in favor of rural dwellers who are basically farmers, in form of roads, small scale irrigation facilities, agricultural machinery and storage facilities are often down played by the policy makers. Higher standards of living are created in the urban areas resulting in the creation of disparity between urban and rural areas. As a result the rural dwellers tend to migrate to the urban areas to take advantage of the favorable policies.

In this study, it is evident that areas around the urban centers have more social amenities and improved infrastructure than the rural areas, arguably policies within the area of study favor the urban areas to the detriment of the rural areas; hence the concentration of facilities and the creation of favorable conditions in the urban areas in line with urban bias theory.

2.3 Empirical Review of Existing Literature

Mundhe and Jaybhaye (2014) assessed the impact of urbanization on land use and land covers in Pune city by analyzing the changes that occurred in land use /land cover (LU/LC) over a time span of the last four decades using modern technology like remote sensing and Geographical Information Systems. Using supervised classification of satellite images it has been found that the built-up area of Pune city increased 1973 to 2011 by 43.43 percent from 28.50 km² to 155.99 km². Also, the areas under vegetation, water bodies, agricultural land and fallow land have been decreased.

Bhagat (2011) in his article "Emerging Pattern of Urbanization in India" examined that the declining trend in the urban population growth rate observed during the 1980s and 1990s was reversed at the national level, and the level of urbanization increased faster during 2001-2011. The urban population grew from 286 million in 2001 to 377 million in 2011 – an increment of 91 million, which is larger than the rural population increment of 90.5 million for the first time since independence. A substantial increase in the urban population is due to a net rural-urban classification and rural-to-urban migration. A huge number of new towns emerged during the last decade, contributing significantly to the speeding up of urbanization. On the other hand, although the contribution of the natural increase in urban growth has declined in terms of proportions, its share in absolute numbers (about 40 million) continues to be huge due to the large base of the urban population. This has implications not only for providing urban infrastructure and civic amenities, but also for reproductive and child health services in urban areas.

Kavitha (2015) in the paper "urban expansion and loss of agricultural land; A case of Bengaluru city" observed that the cultivated land across India has fragmented

significantly resulting in change in land use. The agricultural land was found to shrink due to rapid urbanization. The increase in built up had reduced the agriculture land by 212.49 square kilometers.

Enaruvbe (2015) examined agricultural land use change because of urban encroachment into the agricultural landscape in Asaba between 1987 and 2013. The results showed that cultivation and settlement increased by 1.4% and 1.5% respectively in the first interval and cultivation increased by 0.5% while settlement, forest and water decreased by 0.2%, 0.1% and 1% respectively in the second interval.

Deka *et al.* (2012) showed that the integration of remote sensing (RS) and Geographical Information System (GIS) technique to effectively detect urban growth, emphasizing on the potential applicability of Landsat TM data in the urban studies at both regional as well as local level. This study also indicates the value of medium resolution Landsat images for analysis of urban growth at metropolitan scale, compared to the more resent VRH images.

2.3.1 Literature gap

From the literatures reviewed, different methods of analysis were used to assess the impact of urbanization. This research aims not to only measure the spatial trends in urban and land use land covers change but to also examine other possible socio-economic impacts urbanization may have on the people, such as land encroachments/degradation, soil erosion, flooding, and other factors affecting proper livelihood. Thus, the study seeks to fill the gaps in the reviewed literature by also utilizing an analytical approach that will identify the amount of land gained or lost by one land use and land cover to another in the study areas.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of Materials and Data (Sources of Data)

The data that was used for this work was acquired from different sources and means. They include both primary and secondary data sources, and reconnaissance survey.

3.1.1 Primary data sources

These are researcher's field reconnaissance survey, physical observations and the use of GPS to capture geographical coordinates for training sites that was used during image processing.

3.1.1.1 Questionnaire administration

This involves a well-structured questionnaire which was administered to the respondent in order to gather relevant information on the socio-economic impact of urban growth in the study area and a total of 400 copies of questionnaire were administered.

3.1.2 Secondary data sources

The secondary data that was used in this study include information obtained from textbooks, technical reports, seminar papers, and other published and unpublished works, the internet, journals, all the authors were rightly and dully acknowledged. Satellites imageries was used to produce land use map of the study area, the satellites include; Landsat TM (1988), Landsat ETM (2003) and Landsat 8 (2018) was obtained from the National Center for Remote Sensing. Topographical map of Awka and Onitsha produced by Federal Survey was used as base information to identify the villages that were absorbed at different periods. (iii) Population figure of Awka and Onitsha in 1963,

1991 and 2006 was collected from National Population Commission (NPC), Awka to support the attribute data of the study area.

3.1.2.1 Landsat TM (acquired from 1988)

Landsat 4 is an earth observation satellite which has a sensor compliment Thematic Mapper (TM) was launched on a Delta 3925 vehicle from Vandenberg Air force base CA on March 1, 1984. TM is being regarded as a second generation imager for monitoring Earths resources with considerably improved spectral and spatial resolutions over those of MSS instrument. It is a multispectral mechanically scanning optical imager operating in the visible and infrared regions of the EMS (Electromagnetic Spectrum). The image was acquired from the National space Research and Development Agency (NASRDA).

3.1.2.2 Landsat ETM (acquired from 2003)

Land sat 7 is an earth observation satellite which has a sensor compliment Enhanced Thematic Mapper (ETM) launched on April 15, 1999. Sun- synchronous polar orbit (AM orbit), altitude = 705 km, inclination = 98.2, period = 99 minutes, repeat coverage = 16 days. The image was acquired from the National space Research and Development Agency (NASRDA).

3.1.2.3 Landsat 8 (acquired from 2018)

Landsat 8 is an American earth observation satellite launched on February 11, 2013. It has an objective to collect and achieve medium resolution (30m spatial resolution) multispectral image data affording seasonal coverage of the global land masses for a period of not less than 5 years. The image was acquired from the National space Research and Development Agency (NASRDA).

3.2 Field Data Collection

A field survey was conducted during the period of this study by visiting to study areas which are Awka and Onitsha of Anambra state. Observation of building and infrastructure within the area was carried out, GPS was used to capture the geographical coordinates of various group control point such as schools, markets, banks, etc. within the study areas.

3.3 Method of Data Analysis

3.3.1 Examining changes in land use and land cover

3.3.1.1 Image enhancement: The Landsat images was enhanced by making a 4-3-2 false color composite of the 1988 and 2003 images and 5-4-3 false color composite of the 2018 image. The Near infrared band, Red and green band was selected for the composite due to the high reflectivity of vegetation in the near infrared band thus making it suitable for feature identification, this was done by using the layer stack function on the ERDAS IMAGINE SOFTWARE.

3.3.1.2 Image sub setting: The study area was clipped out from the composite satellite images using the area of interest (AOI) and subset and chip function on the ERDAS IMAGINE SOFTWARE to narrow down the area for classification to the intended study area (Awka and Onitsha respectively).

3.3.1.3 Data processing: The pixels of the images was trained and signatures were created according to the different land covers and the images were then classified using the supervised maximum likelihood algorithm on ERDAS IMAGINE SO. The classified images will then be imported to the Idrisi Selva software to utilize the Land

change modeler (LCM) module. The LCM depicts the gains and losses of area occupied by one land cover to the other over the given period.

3.3.1.4 Supervised image classification:

Table 3.1: Classes delineated on the basis of supervised classification

Sn	Class name	Description
i	Agricultural area	Crop fields and fallow lands
ii	Built up area	Residential, commercial, industrial, transportation, roads, mixed urban
iii	Vegetation	Vegetal cover, shrubs, plantation,
iv	Water body	River, open water, lakes, ponds and reservoirs
v	Bare surface	Rock areas, expose rouged terrain

i. Agricultural area: these are areas that covers areas that has being cultivated for man use and consumption.

Plate I: Nature of Agricultural land in Onitsha. 33, Near Trans Nkisi Layout, Onitsha
Source: Authors Field Survey, 2019

ii. Built up area: these are areas that includes building or structures that are for commercial purposes or residential.

Plate II: Nature of Built up area in Onitsha. Old Market road, GRA, Onitsha
Source: Authors Field Survey, 2019

iii. Vegetation: these are areas with distinct plants types determined by climate, soil, drainage, and elevation. It is a general term without specific reference to a particular taxa life form, structure, spatial extent, or any other specific botanical or geographic characteristics.

Plate III: Nature of vegetation area in Onitsha
Source: Authors Field Survey, 2019

iv. Water body: these are any significant accumulation of water, generally on a planet's surface. A body of water does not have to be still or contained, rivers, streams, canals, and other geographical features where water moves from one place to another are also considered bodies of water.

Plate IV: Nature of Water body area in Onitsha
6.155725, 6.773754 Near water side Onitsha
Source: Authors Field Survey, 2019

v. Bare surface: these are the exposed part of the earth surface that are not permanently cover by water. The vast majority of human activities occur in land areas that support agriculture, habitat, and various natural resources. It also include exposed rock category include areas of bedrock exposure, desert pavement, scarps, talus, slides, volcanic materials, rock glaciers, and other accumulations of rock without vegetative cover, with the exception of such rock exposures occurring in tundra regions.

The LANDSAT data was captured under clear conditions (0% cloud coverage for all the images), hence uniform atmospheric conditions within the images were assumed and no atmospheric corrections were applied. All the images were pre-processed by the USGS to rectify any geometric or radiometric distortions of the image.

For the Landsat TM, ETM+ and Landsat 8, a False Colour Composite (FCC) operation was performed using the Erdas Imagine software and the images was combined in the order of band 4, 3 and 2 for Landsat TM and ETM+ while that of Landsat 8 was in the order of band 5, 4 and 3 due to change in sensor. The images were clipped to the boundary of Awka and Onitsha respectively to allow for more detail and accuracy. The image classification was done by training pixels on the image and registering them to their corresponding land cover type. The sample pixels will be selected by using the points obtained from high resolution Google earth imagery for reference and also other elements of image interpretation such as color, shape, pattern, texture and association will be employed. This was done in order to group features of similar spectral signature across the image into different classes, the classes include built up, agricultural land, vegetation, and bare surfaces. The supervised image classification was done using the ERDAS IMAGINE software and applying the maximum likelihood algorithm. Afterwards, the accuracy assessment was carried out to determine the level of accuracy of the classification. This was done by cross checking the classified image with the initial composite image used for training the pixels. A total number of 50 random points was distributed across the images after making sure they are co-registered and these points were used to check if the class each point falls on the classified image corresponds with the reference image. The accuracy assessment result and the procedure to achieving it will be carried out on Erdas imagine Software. This process will be carried out in order to determine the land use land cover of the study area within the period of coverage.

3.3.1.5 Land change modeling

The land change modeler module on Clark Labs Idrisi Selva software has varying functions, some of which include; Change prediction which predicts the land cover

change for a future year, transition analysis which gives detailed analysis of the pattern land cover change takes place, change analysis which shows the changes that has occurred in the area of land occupied by one land cover type between an image of an earlier year and another image of the later year, etc. In order to achieve the trend in land cover for this research, the Change analysis is going to be utilized, this helped to show the amount of land gained or lost by individual land use land cover, the contributors to the loss of the land use land cover and the amount of land that persists for each land use land cover. This aided in showing the area of land gained or lost and how urban growth has contributed to it in the study area.

3.3.1.6 Software to be used for data analysis

Table 3.1 shows the software to be used in the analysis of this study which includes ArcMap 10.1 for Georeferencing and digitizing map of the study area, Idrisi Selva for image processing and classification.

Table 3.2: Software and their uses for this research

S/N	Software	Uses
1	Idrisi 32 release 2	Image analysis, classification and training site selection
2	ArcMap 10.1	Georeferencing and digitizing of the map of the study area
3	MS Excel	Graphical presentation

Source: Author data analysis, 2019.

3.3.2 Prediction of urbanization trend of Awka and Onitsha of Anambra state Nigeria from 2018 to 2030.

In order to further examine the land use change. The Markov chain analysis and Cellular Automata Analysis in the Markov module of IDRISI was used. The predictive model in IDRISI (Markov module) considers previous land cover changes between two

cover maps as input to produce a transition probability matrix showing the likelihood of each category to change or remain the same in the next period.

Steps for CA-Markov Land use Projection

i. Creating LULC maps from satellites images by image classification techniques (1988-2003-2018)
ii. Using the LULC categories for the years 1988-2003 to simulate the year 2018 in order to validate the model
iii. If the model is useful for the study area, then simulating the LULC categories for the year 2030.

3.3.3 Examine the socio-economic impact of urban expansion in the study Area

The effects of urban growth within Awka and Onitsha were determined through the administration of questionnaire. The questionnaire was distributed to residents of the study area in order to appraise their various views about the existence and rate of socio-economic impacts of urbanization on the people and the environment in general. The responses received from the residents was computed and displayed with the aid of charts and explained through descriptive statistics. The numbers of questionnaire distributed was determined by the calculated sample size.

3.3.3.1 Sampling size

There are various methods in calculating the sampling size of a target population. For example, Smith (n.d) proposed a formula for sample size calculation, which is: (z value)^2 * standard deviation (1 – standard deviation) / (margin of error)^2 = n. This formula, however, can only be used for large populations or unknown population size. Another commonly used method is the method to obtain the sample size; this formula

{N = N ÷ 1+N(e)} makes inference about the population of the study area and it is often associated with human error during calculation. This research adopts the Survey Monkey sample size calculator to determine its sample size. This is online web application software to calculate sample size. This calculator usually allows the researcher to enter the target population size, confidence level and margin of error. In order to ensure a realistic, acceptable and manageable sample size, this research adopts 95% confidence level and 5% margin of error.

Therefore, in adopting the above sampling calculator for the 2018-projected population of Awka (247,276) and Onitsha (342,178), a total number of 800 questionnaire was generated and distributed for the two case studies 400 in the four chosen wards in the study areas. The wards are Awka-I and Okpuno for planned areas and Amawbia-III and Nise-I for unplanned areas in for Awka. And American quarters ward and Inland Town II ward for the planned areas and Trans Nkisi ward and Woliwo Layout ward for unplanned areas Onistha. A total of 100 questionnaire were distributed in each of these wards.

3.3.3.2 Sampling techniques

This study adopted two sampling techniques; the Purposive Sampling Technique and stratified random sampling. The purposive sampling was applied to interviews directed to the relevant MDAs that have the requisite knowledge required for collection of data relating to the subject matter, while the stratified random sampling techniques was used in the various neighborhoods to be interviewed.

Based on the existing number of wards in Awka and Onitsha, which is 20 wards for Awka and 15 wards for Onitsha, 25% of the wards were selected for sampling. These wards or neighborhoods were further stratified into planned and unplanned

neighborhoods for the administration of questionnaire in this research. And equal number of both planned and unplanned neighborhoods was selected for this research. Four (4) wards from the two case studies was sampled for this study, two (2) of the chosen wards were planned area while the other two (2) were an unplanned neighborhood.

3.3.3.3 Population projections

Population projections are calculations of future birth rate, death rate and migration of population based on their past and present conditions (Karuku and Kathula, 2019). They are neither predictions, nor forecasts, nor estimates. Rather they are in between predictions and forecasts. There are three methods of population projection, these includes; Mathematical Method, Growth Component Method, and Economic Method. This research adopts the mathematical method of population projection. This is because in projecting population using Growth Component Method and Economic Method, separate projections for birth rate, death rate and migration by age-sex groups, how and to what extent the birth, death and migration rates are affected by economic factors need to be put into consideration; and there is no reliable data to compute them.

The Mathematical method can further be sub-divided into three types; the S-shape curve projection, the arithmetic method and the geometric method. The geometric formula method was used for the population projection in this study. In this method, it is assumed that the annual change (increase or decrease) in population remains the same throughout the projection period and the crude birth and death rates are taken. The formula for such linear interpolation is

$$Pp = P1(1 + r)n$$

where,

Pp= Projected population;

P1 = Population as per the recent census;

r= Annual rate of increase or decrease of population; and

n = Number of years.

This formula is the basis of Malthus's population projection.

3.3.4 Identification of appropriate measures for sustainability of Awka and Onitsha of Anambra State, Nigeria.

In order to enhance adequate results and analysis from the study areas data was collected from the field survey through suggestions from related relevant materials and administration of questionnaire. The questionnaire was distributed to suggest appropriate measures to make Awka and Onitsha a sustainable city.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Classification of Land use and Land Cover Dynamics (1988, 2003 and 2018)

The classification results for the LULC dynamics are presented using tables, charts and figures for illustration and interpretation of all land use and land cover classes in the three epochs 1988, 2003 and 2018 for the two study areas (Awka and Onitsha) so as to quantify the changes that have taken place over time and space.

4.1.1 Analysis of land use and land cover classification for Awka

4.1.1.1 1988 Satellite imagery LULC classification for Awka

Figure 4.1 shows the land use and land cover map of the study area for 1988. It reveals that agricultural land was the most dominant land cover features covering about 8731.17 hectares (51.07%) of the area. This can be found on every section of the map but more at the centre and towards the north east of the study area. This is followed by vegetation area which covers an area of 7007.58 hectares (40.98%) of the total land mass of the area. Most of the vegetation areas were located majorly in the southern eastern section of the study area as well as south and northern part of the area.

In addition, built up areas cover an area of 1202.76 hectares (7.03%). This is found majorly in the northern section part of the map and in small patches at other section of the area, this land use indicates that in 1988 there were only few settlements in the study. Also, bare surface covers an area of 61.83 hectares (0.36%). Finally, water body covers a total land area of 94.59 hectares (0.55%) and these rivers start flowing from the northern section of the map to western section of the study area as well as a lake at the southern part of map. The total land area of the study area is 17097.93 hectares.

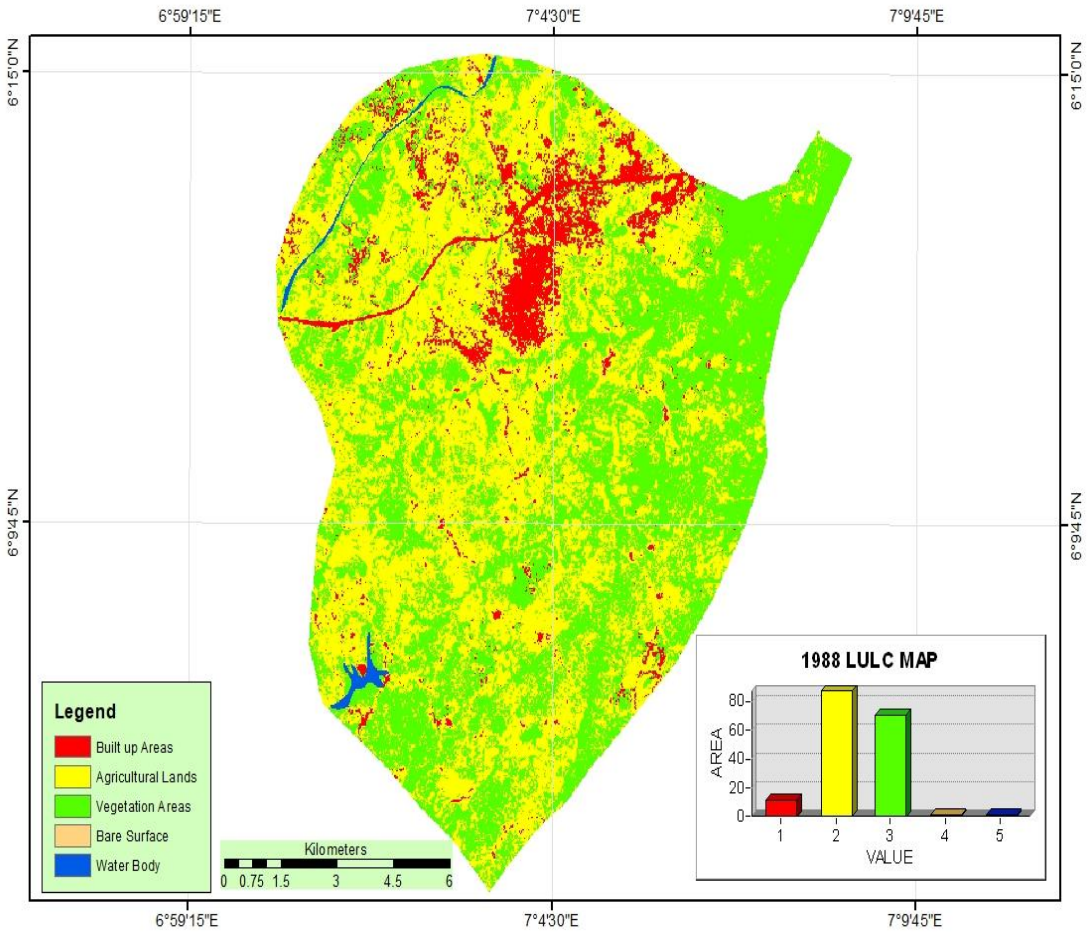

Figure 4.1: Awka 1988 Land use and Landcover distribution map generated from LandSat 4 TM

Source: Author's Analysis, 2019.

4.1.1.2 Analysis of land use and land cover classification of 2003 satellite imagery for Awka

The land use and land cover map of Awka in 2003 (Figure 4.2), reveals that agricultural area was still dominate, although there was decrease within the fifteen years different. It decreases from 8731.17 hectares (51.07%) in 1988 to 6797.52 hectares (39.76%) in 2003. Most of the farmland lands were located majorly in the northern, south eastern and western part of the study area. The large proportion of land cultivated indicates that majority of the populace were farmers due to the fertility of the soil in the area.

Also, vegetation decreased from 7007.58 hectares (40.98%) in 1988 to 6156.72 hectares (36.01%) in 2003. This is found majorly on the southern section of the map as well as north eastern section of the map, however, built up areas witnessed tremendous increase in land areas. The statistics reveals that built up has increased from 1202.76 hectares (7.03%) in 1988 to 2987.19 hectares (17.47%) in 2003.

Bare surface on the other hand covers an area of 1056.51 hectares (6.18%). This can be attributed to increase human activities on the study area. On the other hand, there was a slight increase of water body in the as it covers a total land area of 99.99 hectares (0.58%).

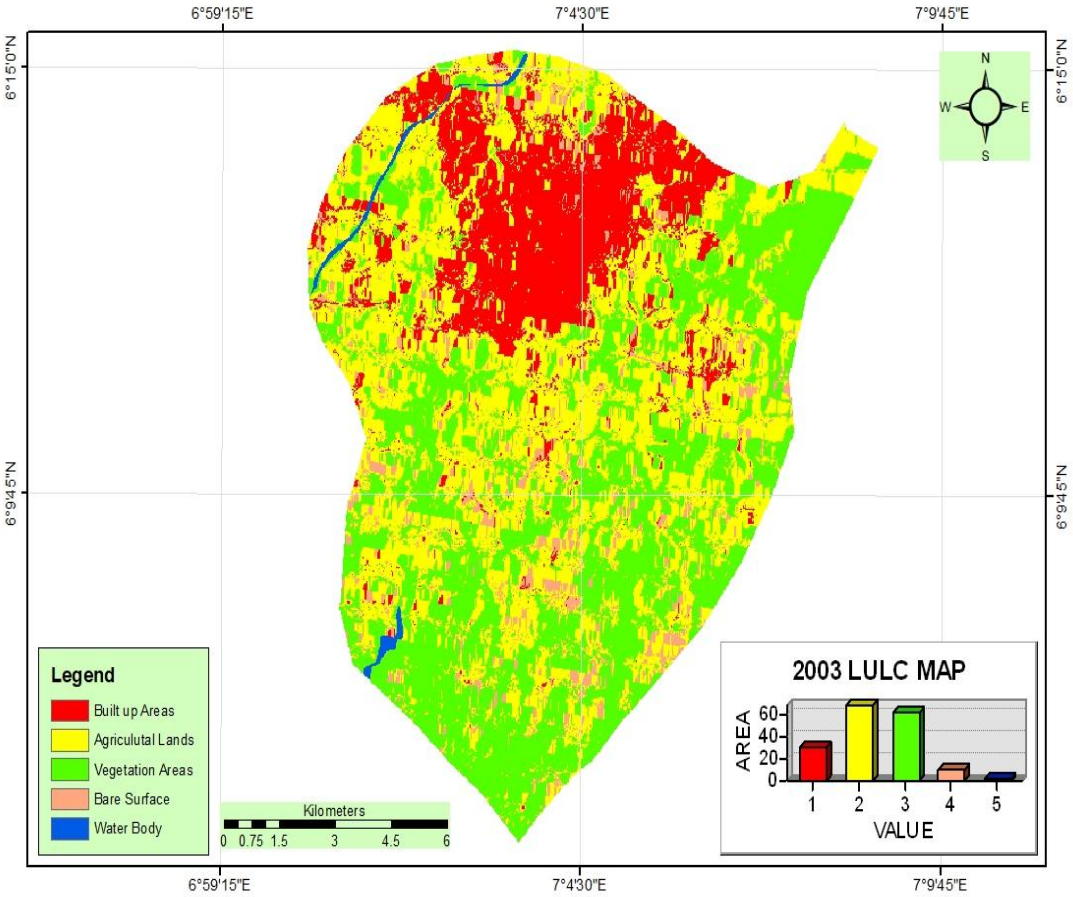

Figure 4.2: Awka 2003 LULC distribution map generated from LandSat 7 ETM+

Source: Author's Analysis, 2018.

4.1.1.3 Analysis of land use and land cover classification of 2018 satellite imagery for Awka

The analysis of 2018 satellite image of the study areas reveals that there was continuous expansion of built up area in the study area. The expansion encroached on other land use category mostly towards eastern and southern section of the area. Figure 4.3 reveals that in 2018 Settlement areas covers a total of 5246.73 hectares (30.70%) of the total area which is made up both residential, commercial, and other land use areas. There was an increase of built up areas by 2259.54 hectares (13.23%) between 2003 and 2018. Similarly, vegetation land also continues to decreases from 6797.52 hectares (39.76%) in 2003 to 5562.45 hectares (32.55%) in 2018 which may be attributed to the continuous influx of people in the area leading to increased deforestation activities as well as pressure on other available vegetation resources. Agricultural land on the other hand decreased further to 5521.14 hectares (32.31%) in 2018, which can be attributed to the conversion of Agricultural land to other land uses. Furthermore, bare surface covers an area of 673.74 hectares (3.94%) in 2018 while Water body decreased to 86.22 hectares (0.50%) in 2018.

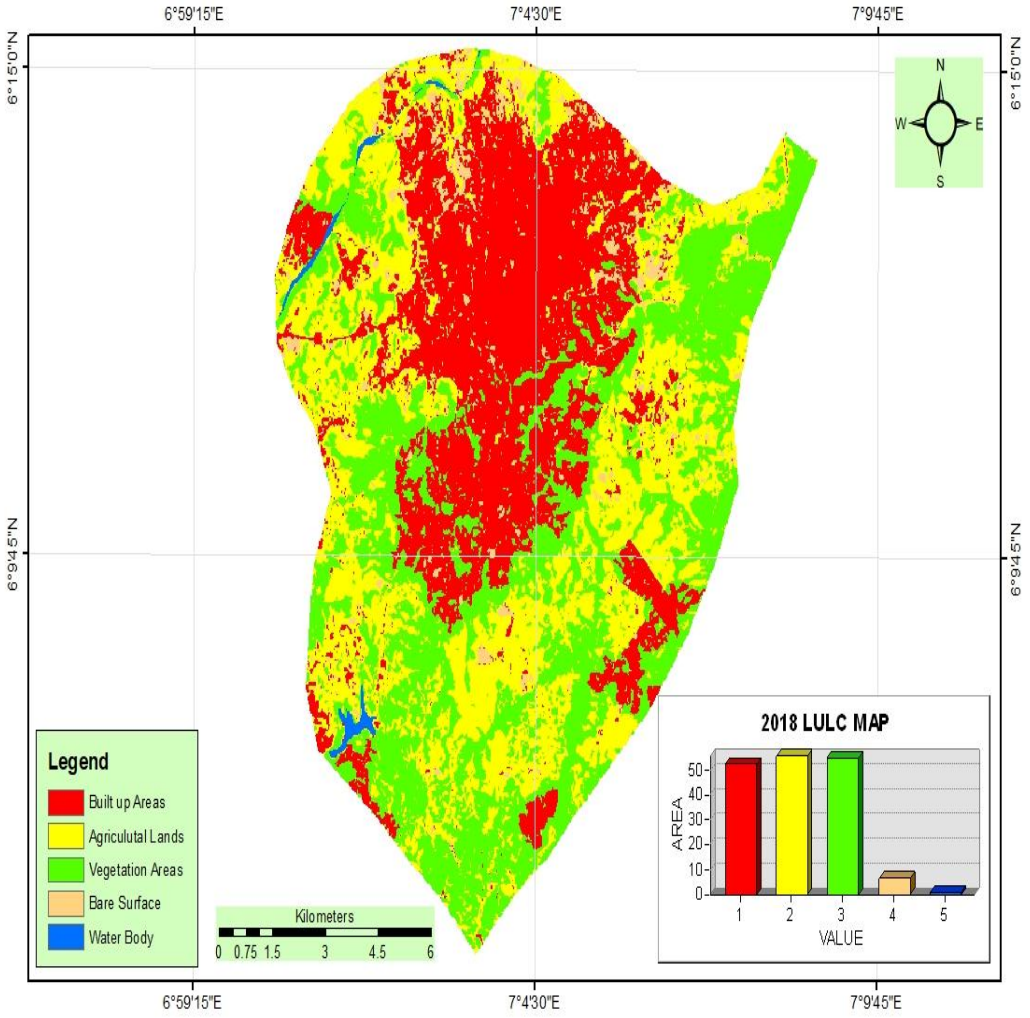

Figure 4.3: Awka 2018 LULC distribution map generated from Landsat 8 OLI

Source: Author's analysis 2019

Table 4.1: Percentage of land use and land cover in Awka (1988, 2003 and 2018)

Classification Category	1988		2003		2018	
	Rate (Ha)	Area (%)	Rate (Ha)	Area (%)	Rate (Ha)	Area (%)
Built up Area	1202.76	7.03	2987.19	17.47	5246.73	30.70
Agricultural land	8731.17	51.07	6797.52	39.76	5562.45	32.55
Vegetation	7007.58	40.98	6156.72	36.01	5521.14	32.31
Bare surface	61.83	0.36	1056.51	6.18	673.74	3.94
Water Body	94.59	0.55	99.99	0.58	86.22	0.50
Total	**17097.93**	**100**	**17097.93**	**100**	**17097.93**	**100**

***Source**: Author's analysis 2019*

4.1.1.4 Analysis of Built up Extent in Awka

The extent of urban land use has been progressively increasing throughout the study period as shown on table 4.2.

Table 4.2: The Extent of Urban land cover change for Awka in 1988, 2003 and 2018

S/N	Year	Urban Area (Ha)	(%)
1	1988	1202.76	7.03
2	2003	2987.19	17.47
3	2018	5246.73	30.70

Source: Author's analysis 2019

The year 1988 had the least extent of urban land which constituted 1202.76 hectares (7.03%). This was preceded by the years 2003 (15 years later) where the extent of urbanization rapidly increased to 2987.19 hectares (17.47%). This rapid increase could however be accounted for by the increase in housing facilities for local government staff as well as the influx of the rural population coming to seek for a greener pasture in the urban area. More urban expansion resulting from continuous dividends of democracy which increased administrative and commercial activities resulted in an increase in the extent of urban area to 5246.73 hectares (30.70%) in 2018.

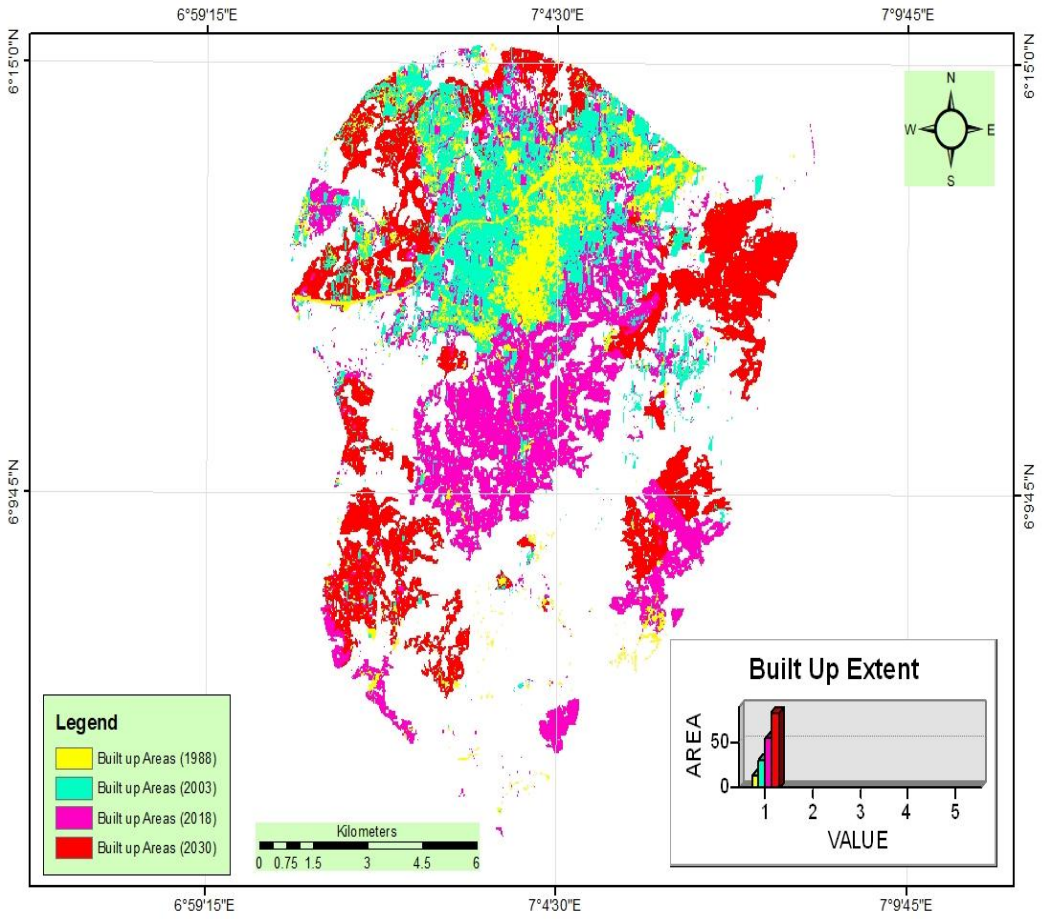

Figure 4.4: Spatial Extent of Urban Expansion for Awka
Source: Author's analysis 2019

4.1.2 Analysis of land use and land cover classification for Onitsha

4.1.2.1 Analysis of land use and land cover classification of 1988 satellite imagery for Onitsha

Land use and land cover Analysis of 1988 imagery of Onitsha (Figure 4.5) reveals that agricultural land areas were the most dominant land cover features covering about 1242.18 hectares (43.14%) of the area. This can be found at different section of the map of the study area. This is followed by vegetation areas which covers an area of 839.07 hectares (29.14%) of the total land mass of the area. Most of the vegetation areas were located majorly in the southern sections of the study area.

Also, built up cover an area of 574.83 hectares (19.96%). This is found majorly in the northern part of the map and in small patches at other section of the area, this land use indicates that in 1988 they were few developments at that time across the study area. Bare surface accounted for 207.09 hectares (7.19%) were typically found at the northern section and in small patches in western, section of the study area. Furthermore, water body covers a total land area of 16.29 hectares (0.57%) and these rivers start flowing from the northern, north western to southern section of the study area. The total land area of the study area is 2879.46 hectares.

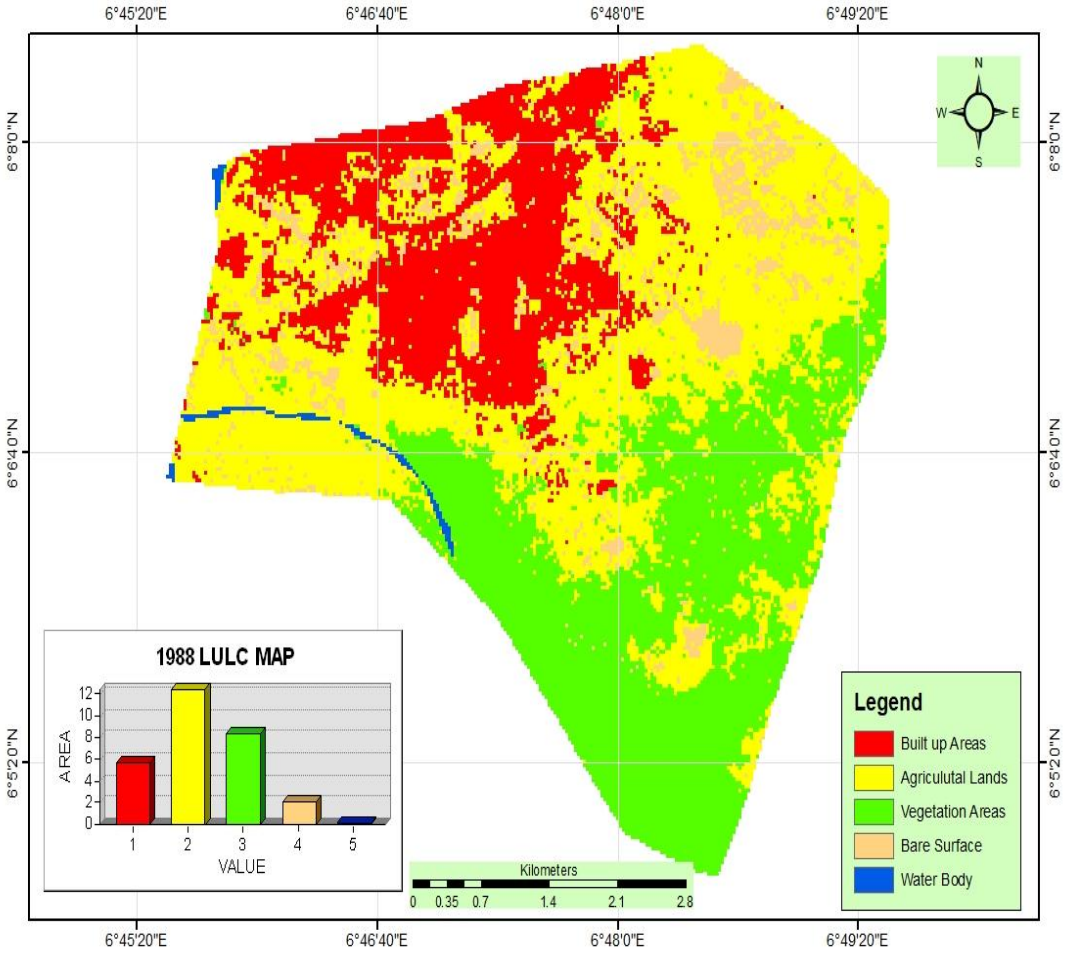

Figure 4.5: Onitsha 1988 LULC distribution map generated from LandSat 4 TM
Source: Author's Analysis, 2019.

4.1.2.2 Analysis of land use and land cover classification of 2003 satellite imagery for Onitsha

Land Use and Landcover Analysis of 1988 imagery of Onitsha (Figure 4.5) reveals that built up areas has increased drastically and were found to be the most dominant land cover features covering about 947.79 hectares (32.92%) of the area. This can be found more at the northern section as well as extending towards the south of the map of the study area. This is followed by vegetation areas which covers an area of 916.83 hectares (31.84%) of the total land mass of the area. Most of the vegetation areas were located majorly in the southern as western sections close to river Niger section of the study area.

However, it suffices to note that agricultural land decreased from 1242.18 hectares (43.14%) in 1988 to 816.30 hectares (6.38%) in 2003.This is found majorly in the eastern part of the map and in small patches at other section of the area, this land use indicates that in 2003 there were major development across the study area which has resulted in the conversion of agricultural land to other land use type. On the other hand, bare surface accounted for 183.60 hectares (6.38%) were typically found in small patches at different section of the study area. Furthermore, there was a slight decrease in water body which covers a total land area of 14.94 hectares (0.51%) in 2003 and these rivers are found majorly in the western and southern section of the study area.

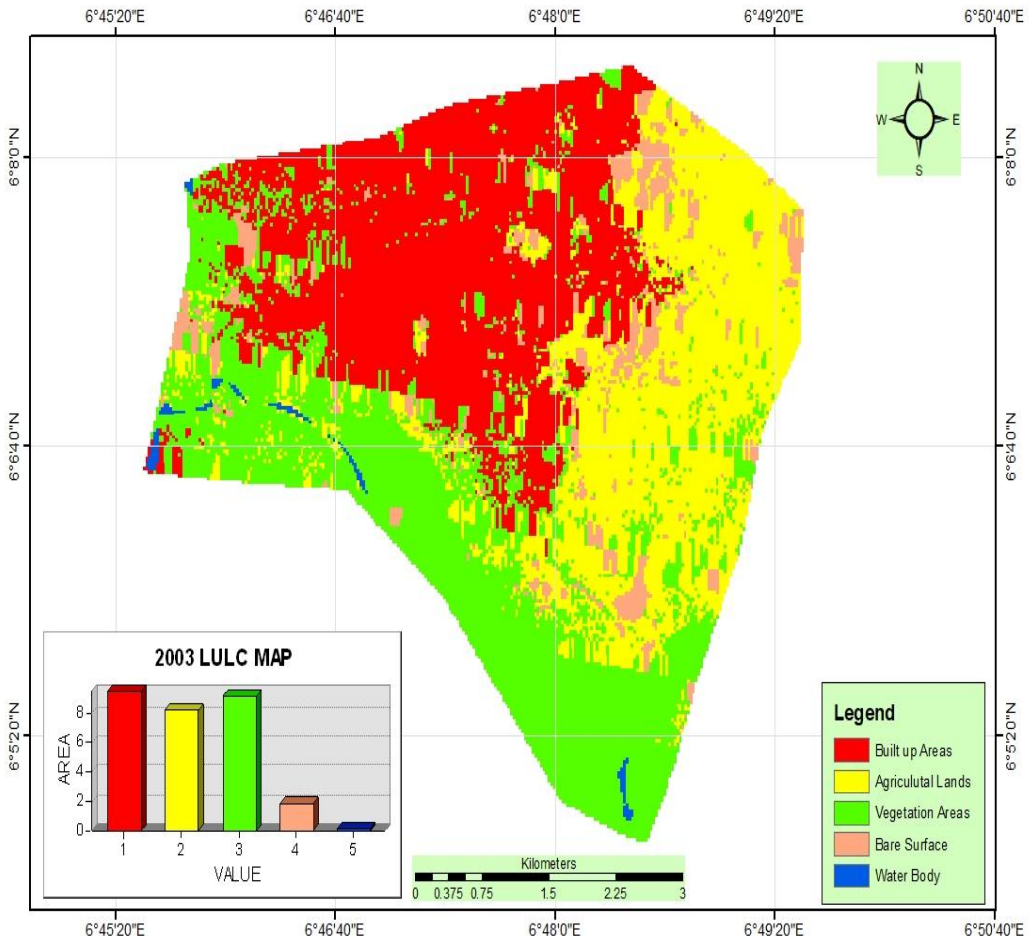

Figure 4.6: Onitsha 2003 LULC distribution map generated from Landsat 7 ETM+
Source: Author's Analysis, 2019.

4.1.2.3 Analysis of land use and land cover classification of 2018 satellite imagery for Onitsha

The result of the land use and land cover changes for 2018 was analysed and the Statistical means for each land use and land cover shows that there was both positive and negative change as depicted by the various land use and land cover category.

Built-up areas from the statistical analysis of this research formerly occupied a proportion of 574.83 hectares (19.96%) in 1988 and increased to 1199.25 hectares (41.65%) in 2018. this is a clear indication of increase in population and infrastructure development in the metropolis, regardless of use or pattern. This agrees with the work of Onwuka *et al.,* (2017) who analysed land use/cover dynamics in Onitsha metropolis and result indicates that urbanization is on the increase due to the commercial activities in the area.

Vegetation cover on the other hand also decreased to 399.69 hectares (13.88%) in 2018 from 839.07 hectares (29.14%) in 1988. This decreased can be attributed to increased demand for land as population influx continues to increase in the area for one activity or the other. bare surface proportion was 207.09 hectares (7.19%) in 1988 but increased to 474.30 hectares (16.47 %) in 2018. this can be attributed to human activities, which includes, over grazing, indiscriminate bush burning, fire wood extraction which are some of the characteristics of most regions of Nigeria.

Agricultural lands also regardless of type of crops and their level of intensity; cultivated or uncultivated show a negative increase. in 1988, what was obtainable was 1242.18 hectares (43.14%) and while in 2018 its 790.65 hectares (27.46%). this can be as a result of built-up areas in the area. water bodies the proportion of the study area under water bodies recorded a negative change although very minimal in nature. in 1988 result

shows 16.29 hectares (0.57%) and while in 2018 this class represents a proportion of 15.57 hectares (0.54%). this may be due sand deposit, land reclamation and other developmental activities along the coast.

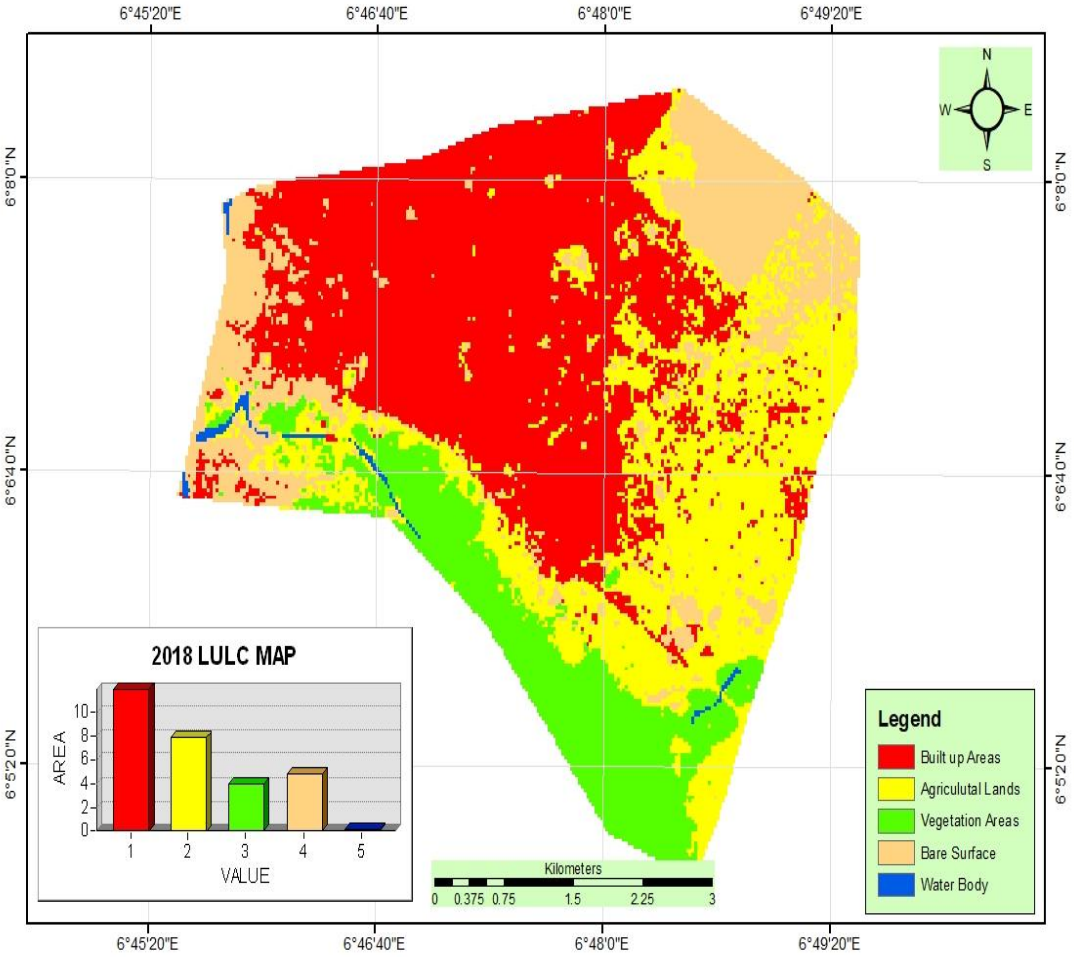

Figure 4.7: Onitsha 2018 LULC distribution map generated from Landsat 8 OLI
Source: Author's analysis 2019

Table 4.3: Percentage of land use and land cover in Onitsha (1988, 2003 and 2018)

Classification Category	1988		2003		2018	
	Rate (Ha)	Area (%)	Rate (Ha)	Area (%)	Rate (Ha)	Area (%)
Built up Area	574.83	19.96	947.79	32.92	1199.25	41.65
Agricultural land	1242.18	43.14	816.30	28.35	790.65	27.46
Vegetation	839.07	29.14	916.83	31.84	399.69	13.88
Bare surface	207.09	7.19	183.60	6.18	474.30	16.47
Water Body	16.29	0.57	14.94	0.51	15.57	0.54
Total	**2879.46**	**100**	**2879.46**	**100**	**2879.46**	**100**

Source: Author's analysis 2019

4.1.2.4 Analysis of Built up Extent in Onitsha

The extent of urban land use has been progressively increasing throughout the study period as shown on table 4.4.

Table 4.4: The Extent of Urban land cover change in Onitsha for 1988, 2003 and 2018

S/N	Year	Urban Area (Ha)	(%)
1	1988	574.83	19.96
2	2003	947.79	32.92
3	2018	1199.25	41.65

Source: Author's analysis 2019

The year 1988 had the least extent of urban land which constituted 574.83 hectares (19.96%). This was preceded by the years 2003 (15 years later) where the extent of urbanization rapidly increased to 947.79 hectares (32.92%). This rapid increase could however be accounted for by the increase in housing facilities for local government staff, business men and women as well as the influx of the rural population coming to seek for a greener pasture in the urban area for opportunities or the other. More urban expansion resulting from continuous dividends of democracy which increased administrative and commercial activities resulted in an increase in the extent of urban area to 5246.73 hectares (30.70%) in 2018.

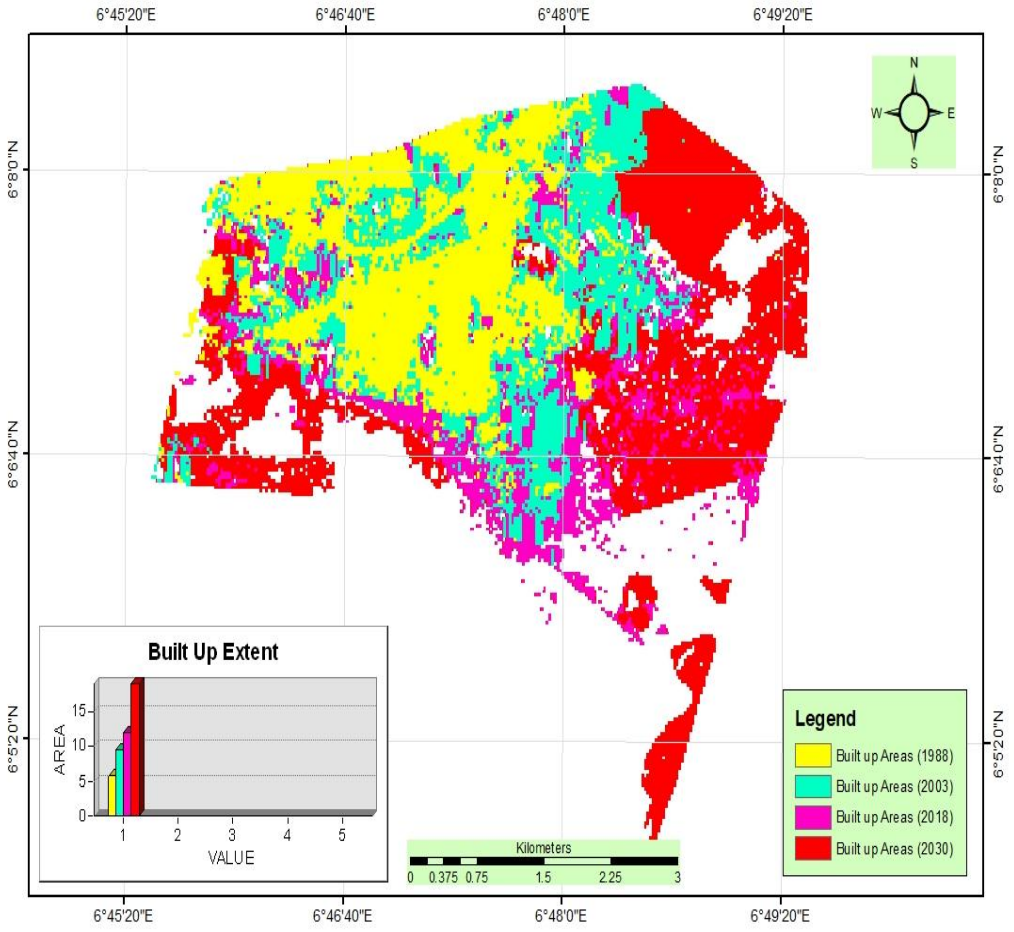

Figure 4.8: Spatial Extent of Urban Expansion for Onitsha

Source: Author's analysis 2019

4.1.2.5 Built up trend across the two study areas

The Figure 4.9 explains the period of 1988 - 2003 covering 15 years, urban area increased (10.44%) and between 2003 and 2018 covering 15 years also, urban areas increase by 13.23% in Awka. This agrees with the work of Ojiako *et al.,* (2018) whose finding reveals that Awka has been undergoing extensive land use change majorly as a result urban growth. Similarly, in Onitsha the urban areas increase was (12.96%) between 1988 -2003 covering 15 years, urban areas increase further by (8.73%). This is an indication of continuous land use conversion of other land use to urban areas. It suffices to note that urbanization has increased drastically across the study areas which may have a negative implication on the inhabitant if sustainable measures are not put in place to check developmental activities in the areas. This agrees with the work of Nwaogu *et al.,* (2017) who monitor urban growth in Onitsha and find out that there is continuous expansion of settlement as a result of influx of people to the area. The findings further reveal that other land use category is rapidly transforming into lands for housing, commercial and industrial purposes.

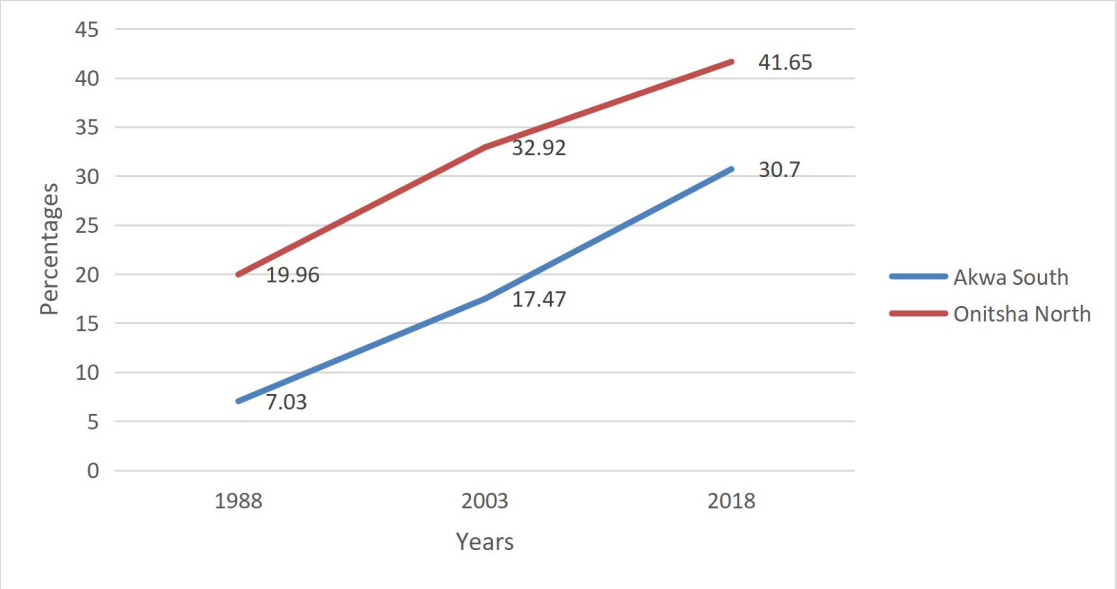

Figure 4.9: Trend Analysis of Built up increase across the Study Areas
Source: Author's analysis 2019

4.1.3 Comparison of classification accuracy (1988, 2003 & 2018) for Awka and Onitsha LULC Imagery

The accuracy assessment for the LULC image classification gives a vivid explanation on how well the classification worked by comparing reference to classified map. Table 4.5 gives the overall classification accuracy of the Onitsha LULC imagery, indicating that 1988 is 80.45%, 2003 is 82.25% and 2018 is 83.70%.

Table 4.5 Comparison of Classification Accuracy (1988, 2003 & 2018) for Onitsha LULC Imagery

Class Name	1988		2003		2018	
	Producer's Accuracy (%)	User's Accuracy (%)	Producer's Accuracy (%)	User's Accuracy (%)	Producer's Accuracy (%)	User's Accuracy (%)
Water body	96.00	92.10	96.00	93.30	88.00	82.10
Bare Surface	79	64.04	96.70	91.40	92.00	90.33
Vegetation	88.71	89.30	89.64	90.00	97.80	95.55
Agriculture	84.29	85.65	94.10	89.20	86.70	80.35
Built-up	81	79.76	85.90	80.50	87.20	84.60
Overall Classification Accuracy (%)	**80.45**		**82.25**		**83.70**	
Overall Kappa	**0. 79**		**0.804**		**0.84**	

Source: Authors' Data Analysis, 2020.

Table 4.6 gives the overall classification accuracy of the Awka LULC imagery, indicating that 1988 is 87.50%, 2003 is 88.34% and 2018 is 89.70%. this result shows that there is an accuracy in the map made from the case study.

Table 4.6 Comparison of Classification Accuracy (1988, 2003 & 2018) for Onitsha LULC Imagery

Class Name	1988		2003		2018	
	Producer's Accuracy (%)	User's Accuracy (%)	Producer's Accuracy (%)	User's Accuracy (%)	Producer's Accuracy (%)	User's Accuracy (%)
Water body	100.00	98.20	98.00	96.70	94.80	92.00
Bare Surface	89.50	86.60	97.20	96.70	92.00	84.00
Vegetation	85.22	80.00	99.01	95.50	100.00	96.40
Agriculture	90.37	96.40	96.30	94.90	93.10	90.00
Built-up	98.55	95.10	93.40	96.00	96.90	95.00
Overall Classification Accuracy (%)	**87.50**		**88.34**		**89.70**	
Overall Kappa	**0. 843**		**0.852**		**0.865**	

Source: Authors' Data Analysis, 2020.

4.2 Simulation Analysis of Land Use and Land Cover for 2030

The growth of urbanization on the study area for the year 2030 on the two locations was analyse one after the other in order to examine the extent of urban expansion in the study areas.

4.2.1 Result validation of the study areas on classified LULC of 2018 and predicted LULC of 2018

The state transition area matrix and state transition probability matrix are created according to land use maps in 1988 and 2003, which can be obtained by running the CA-Markov model in IDRISI software based on the suitability atlas that has already been created. The predictive results map for 2018 is obtained with a 5×5 contiguity

filter, whose running cycle is 15 years. Figure 4.10 is the predicted map of 2018 for Awka and Onitsha.

Commonly, if the Kappa index is less than or equal to 0.4, then the land uses changed greatly and with poor consistency between the two images. If the Kappa index is 0.4–0.75, then there are general consistencies and obvious changes between the two images. Otherwise, there is high consistency between two images (Yousheng *et al.,* 2011). Usually, the Kappa values range from 0 to 1. Values of 0.61–0.80 means substantial, while 0.81–1 means almost perfect (Yousheng *et al.,* 2011). However, the Kappa index between the predicted map and the observed map of 2018 is 0.791 and 0.82 for Awka and Onitsha illustrating that the results are reliable. This agrees with the work of (Igbokwe *et al.,* 2013) that carried out study of simulation models in terms of quantity and allocation of land change. There was high consistency between the actual classified results and predictive results. The precision for correct predictions is relatively high; therefore, this method was used to predict the results in 2030 (Figure 4.10).

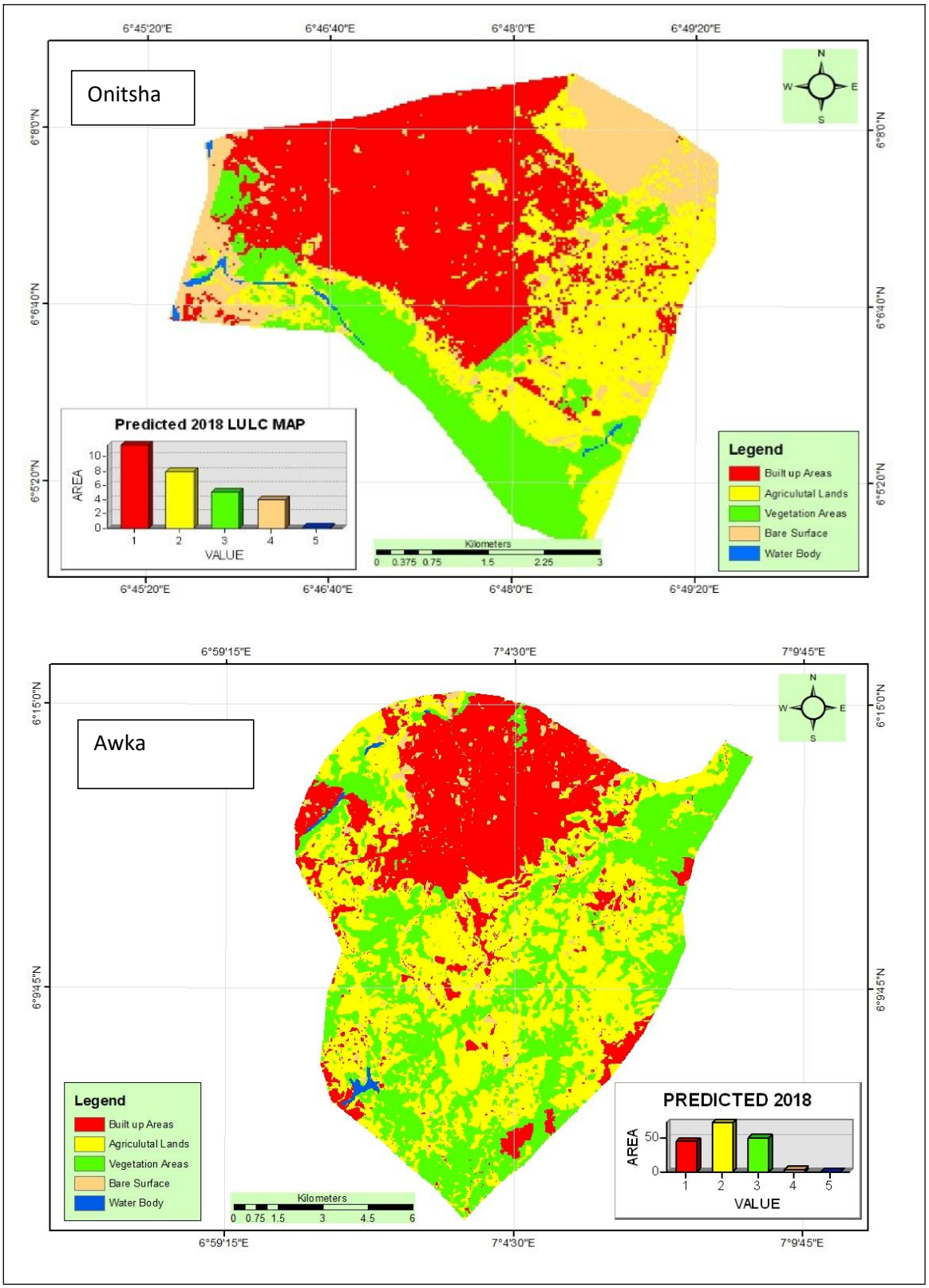

Figure 4.10: Result Validation and Predicted LULC Map of 2018
Source: Author's analysis 2019

4.2.2 Simulation analysis of land use and land cover of Onitsha for 2030

The simulated land use land cover map in Figure 4.11 for the year 2030 indicates that there was a constant increase in the built-up areas from 1199.25 hectares (41.65%) in 2018 to 1890.99 hectares representing (65.70%) in 2030 of the land use class categories, this indicates an increment of 691.74 hectares representing (24.05%). The projection of LULC in the year 2030 clearly shows that the urban area will increase rapidly due to the high population growth most especially as a result of Onitsha been one of the largest commercial cities in Africa with its population growth rate increasing arithmetically for the past two decade (Nwaogu *et al.,* 2017). Hence, urbanization has increase at the expense of other LULC classes.

These increase in population with rapid settlement growth encroaching into vegetation and agricultural land as people seek to develop more areas making the area vulnerable to the risks of climate change and flooding and other environmental degradation in the future. Also with the influx of people to the area, this will put further pressure on the available resource by people from different part of the country thereby reducing more agricultural land which will affect food production in the future.

In addition, Agricultural land will also be affected because of increased in built up area and developmental activities in the area. Agricultural land will reduce from 790.65 hectares (27.46%) in 2018 to 405.45 hectares (14.08%) in 2027 indicating a decrease of (13.38%) due to people increased demand for land area. Furthermore, the future land use map will see vegetation witness a minimal increase from 399.69 hectares (13.88%) in 2018 to 424.98 hectares (14.77%) in 2030, a slight increase of (0.89%). The bare surface also decreased from 474.30 hectares (16.47 %) in 2018 to 140.85 hectares (4.89%) in 2030 due to increased construction activities in the area leading to more

exposed surfaces than previous years. Finally, water body decreased slightly from 15.57 hectares (0.54%) in 2018 to 15.75 hectares (0.52%) (figure 4.11).

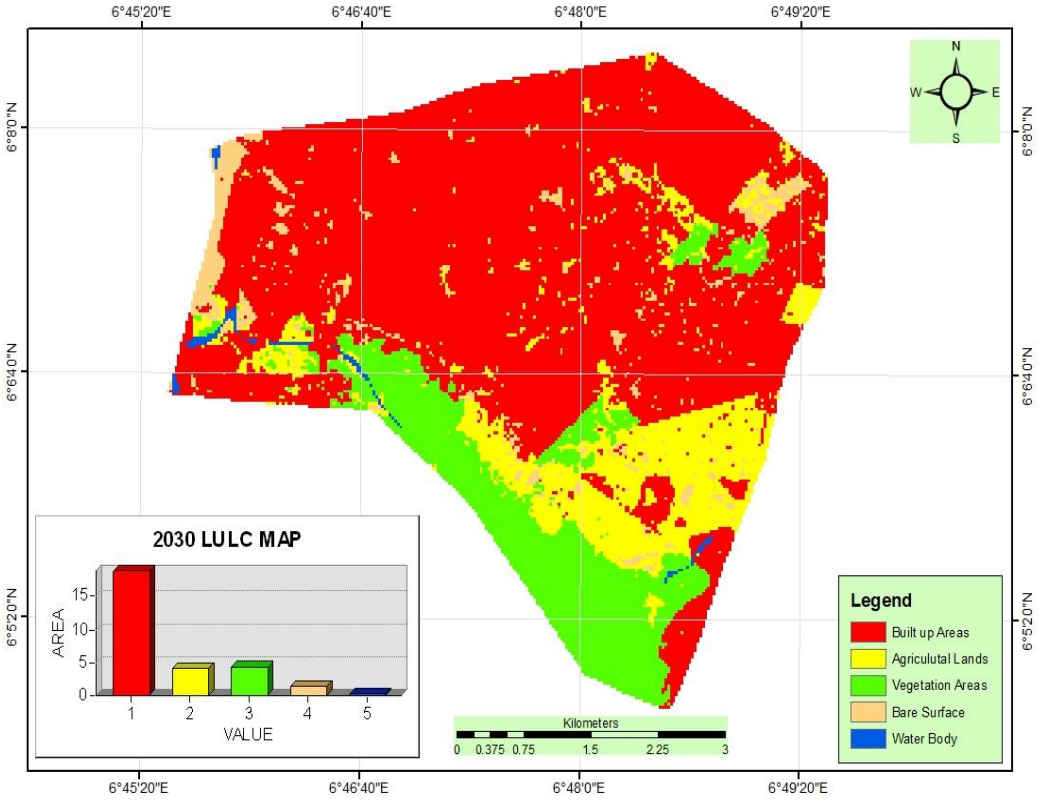

Figure 4.11: Simulated 2030 Land Use and Land Cover Map of Onitsha
Source: Author's analysis 2019

4.2.3 Simulation analysis of land use and land cover of Awka for 2030

The projected land use land cover map in Figure 4.12 for the year 2030 shows continuous increase in the built-up areas from 5246.73 hectares (30.70%) in 2018 to 8031.69 hectares representing (46.99%) in 2030 of the land use class categories. This Indicate an increment of 2784.96 hectares representing (16.29%). The projection of Land use and land cover to the year 2030 shows that the urban area will increase rapidly due to the high population growth in the area at the expense of other land use and land cover classes. These increase in population with rapid settlement growth encroaching into vegetation and agricultural land making the area vulnerable to the risks of climate

change in the future. Urban areas will be concentrated more on the northern section of the study area as well as southern, eastern and western areas of the map.

In addition, Agricultural land will also be affected because of increased in built up area and developmental activities in the area. Agricultural land will reduce from 5521.14 hectares (32.31%) in 2018 to 3593.79 hectares (21.03%) in 2030. Furthermore, the future land use map will see vegetation cover also continue to decrease from 5562.45 hectares (32.55%) in 2018 to 4797.18 hectares (25.96%) in 2030, a decrease of (6.59%) which may be attributed to deforestation.

The bare surface also increased from 673.74 hectares (3.94%) in 2018 to 591.12 hectares (3.46%) in 2030 due to increased construction activities in the area leading to more exposed surfaces than earlier times. Finally, the proportion of water body will be 76.50 hectares (0.45%) in 2030 (Figure 4.12).

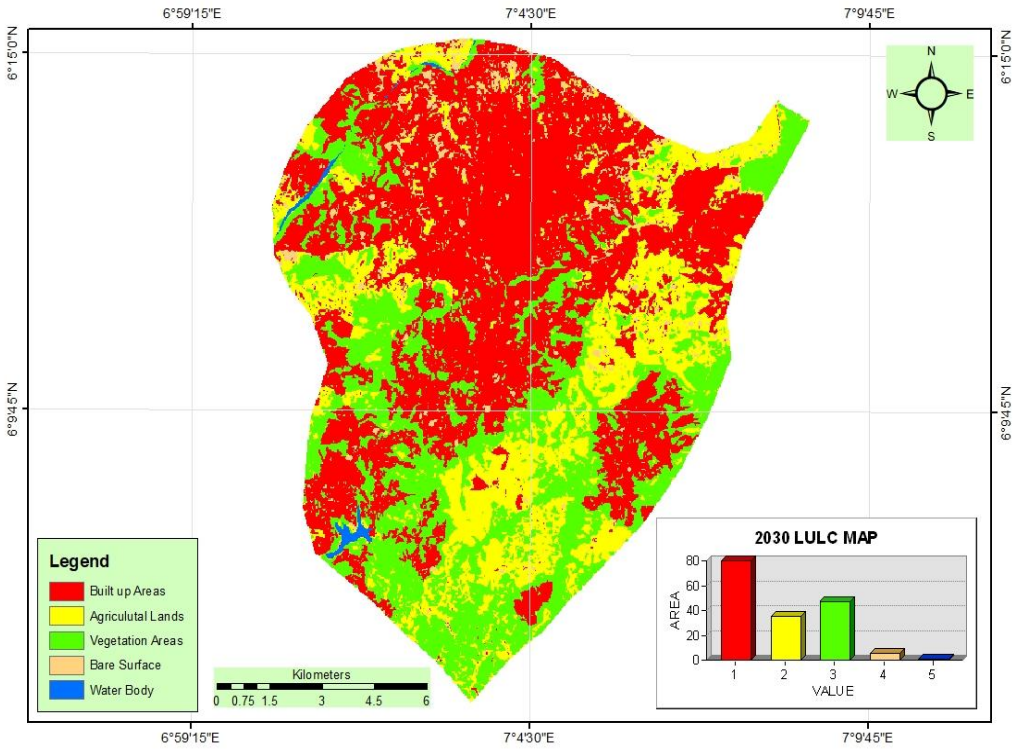

Figure 4.12: Simulated 2030 Land Use and Land Cover Map of Awka
Source: Author's analysis 2019

4.3 Examine the socio-economic impact of urbanization in the study area.

In the assessment of the level of compliance of Awka and Onitsha city with international best practices for sustainable development, a structured questionnaire was design and administered in some selected neighbourhoods in four (4) wards of the Awka and Onitsha. The neighbourhoods were select based on pre-set conditions of either being planned or unplanned. Neighbourhoods with good accessibility/road network, planned layout, modern building materials and good structural condition are classify as planned, while those with poor conditions are unplanned. Table 4.7 and 4.8 shows the various neighbourhood and their condition.

The questions were centre on the environmental sustainability of the study area, and focus on the key indicators for environmental sustainability by international standard (UN-Habitat).

Table 4.7 Distribution of questionnaires in Awka

Physical condition	Wards	Neighbourhood	Number of questionnaires distributed	Number returned	Total returned
Planned area	Okpuno	Nodu	25	18	82
		Okochi	25	21	
		Okpu	25	20	
		Umu-odu	25	18	
Planned area	Amawbia III	Ngene	25	22	84
		Umukabia	25	21	
		Ezimezi	25	20	
		Eno-oji	25	24	
Unplanned area	Awka I	Umunoke	25	23	86
		Umuorama	25	18	
		Nkwelle	25	23	
		Nyom Na Okpala	25	22	
Unplanned area	Nibo I	Ezeawulu	25	21	78
		Umuanum	25	19	
		Ifite	25	18	
		Ezeoye	25	20	
Total			**400**		**331**

Source: Author's Work

Table 4.8 Distribution of questionnaires in Onitsha

Physical condition	Wards	Neighbourhood	Number of questionnaires distributed	Number returned	Total returned
Planned area	American Layout	GRA 430	33	28	86
		Ose II	33	29	
		Omagba Layout	34	29	
Planned area	Inland Town II	Abutu	50	37	85
		Okosi Road	50	48	
Unplanned area	Trans nkisi	Marine road	50	35	83
		33	50	48	
Unplanned area	Woliwo Layout	Upper Iweka	34	29	88
		Nkpor	33	29	
		Woliwo	33	30	
Total			**400**		**342**

Source: Author's Work

4.3.1 Demography and General Information

4.3.1.1 Gender distribution of respondents

Table 4.9 shows most respondents were female rather than male in the Awka, while in Onitsha there were more male respondents. In Onitsha 59% of respondents interviewed were male while in Awka 56% of the respondents were females.

Table 4.9: Gender distribution of respondents

Sex	Awka	Onitsha
Male	144 (44%)	202 (59%)
Female	187 (56%)	140 (41%)
Total	**331 (100%)**	**342 (100%)**

Source: Author's analysis 2019

4.3.1.2 Age of respondents

The Table 4.10 shows the age group of the respondent in the study area. It was observed that majority of the respondents sampled both from Awka and Onitsha is within the age group of 30-39 years. In Awka 53% of the respondent are within the age group of 30-39 and 56% respondents from Onitsha. Also, it's followed by age group within 20-29 years where Awka and Onitsha are both having 26% and 29% of the sampled respondents.

Table 4.10: Age distribution of respondents

Age	Awka	Onitsha
20 – 29 years	89 (26%)	98 (29%)
30 – 39 years	175 (53%)	192 (56%)
40 – 49 years	37 (12%)	22 (6%)
50 – 59 years	12 (4%)	18 (5%)
60 years and above	18 (5%)	12 (4%)
Total	**331 (100)**	**342 (100)**

Source: Author's analysis 2019

4.3.1.3 Educational background of respondents

Table 4.11 shows the levels of education among the respondents range from no education to Post graduate. The analysis indicates that the level of education is higher in the Awka than Onitsha. As shown from the table, fewer respondents in Awka of 2% have no education compared to that of Onitsha with 6%.

In terms of primary level education, it is shown from the table that the majority of respondent in both Awka and Onitsha had attained primary education; however, Onitsha seemed to have more respondent who had reached this level with 12% compared to Awka 8%. As indicated from table (6), the greater differences between Awka and Onitsha samples are evident when secondary and tertiary levels of education are considered.

Table 4.11 Educational background of respondents

Education level	**Awka**	**Onitsha**
No formal education	8 (2%)	21 (6%)
Primary	25 (8%)	40 (12%)
Secondary	163 (49%)	155 (45%)
NCE/OND	49 (15 %)	88 (26%)
HND/BSC	78 (24%)	37 (11%)
Post Graduate	8 (2%)	1 (0%)
Total	**331(100)**	**342(100)**

Source: Author's analysis 2019

4.3.1.4 Respondents occupation

The Table 4.12 shows that majority of the respondent occupation in Awka are student which has 52% of the analysis made, followed by civil servant with 20%, this could be as the result of the presence of Nnamdi Azikwe University located in the area. This is compared to Onitsha which has majority of the occupation to be trade of 38% followed by students with 29% having it in mind that the largest market in West Africa is located in Onitsha.

Table 4.12 Respondents occupation

Occupation	Awka	Onitsha
No Response	9 (3%)	5 (1%)
Trade	51 (15%)	140 (42%)
Farming	19 (6%)	18 (5%)
Civil servant	66 (20%)	65 (19%)
Retired	13 (4%)	8 (2%)
Others (Students)	173 (52%)	106 (31%)
Total	**331 (100)**	**342 (100)**

Source: Author's analysis 2019

4.3.2 Resident perception on land use and land cover change

4.3.2.1 Dominant land use type 10 years ago

In terms of the dominant land use present 10years ago (2009) information in Table 4.13 shows that Awka as well as Onitsha has settlement as the major land cover in the area. Awka has 41% respondents followed by commercial land which has 14% respondents and Onitsha has 37% respondents followed by commercial land with 28% respondents.

Table 4.13 Dominant land use type 10 years ago (2009)

LULC	Awka	Onitsha
Settlement	135 (41%)	125 (37%)
Farmland	40 (12%)	29 (8%)
Commercial land	47 (14%)	95 (28%)
Forest wood	85 (26%)	61 (18%)
Water bodies	14 (4%)	18 (5%)
Open Bare/land	10 (3%)	14 (4%)
Total	**331 (100)**	**342 (100)**

Source: Author's analysis 2019

4.3.2.2 Dominant land use type presently

In terms of the dominant land use currently present, it was analyzed in Table 4.14 shows that Awka as well as Onitsha has settlement to be the major land cover in the area. Awka has 62% respondents followed by commercial land which has 18% respondents and Onitsha has 51% respondents followed by commercial land with 34% respondents. It is seen that there is a reduction of commercial land in Awka compared to Onitsha which has an increase in commercial land.

Table 4.14 Dominant land use type presently.

LULC	Awka	Onitsha
No Response	5 (2%)	4 (1%)
Settlement	205 (62%)	175 (51%)
Farmland	14 (4%)	8 (2%)
Commercial land	59 (18%)	116 (34%)
Forest wood	34 (10%)	22 (6%)
Water bodies	8 (2%)	13 (4%)
Open Bare/land	6 (2%)	5 (1%)
Total	**331 (100)**	**342 (100)**

Source: Author's analysis 2019

4.3.2.3 What is the current status of each land use?

The Table 4.15 shows that there is a tremendous increase in settlement and commercial land in both Awka at about 92% and Onitsha with about 70% for settlement. Also, there is an increase in commercial land for both Awka at 90% and Onitsha at 92%. These follows with consecutive decrease in farmland, forest/vegetation, water bodies, and open/bare land for both Awka and Onitsha. Plate V and VI below shows the current status of each land use.

Table 4.15 The current status of each land use

Land use	Increased		Decreased		Neutral	
	Awka	Onitsha	Awka	Onitsha	Awka	Onitsha
Settlement	276(92%)	208 (70%)	14 (5%)	19(6%)	9 (3%)	60 (20)
Farmland	42(14%)	69(23%)	202(67%)	178(59%)	50 (17%)	51 (17%)
Commercial	269(90%)	276(92%)	9 (3%)	14 (5%)	10 (3%)	9 (3%)
Forest/vegetation	49 (16%)	89(30%)	150(50%)	155(52%)	89 (30%)	49 (16%)
Water bodies	52 (17%)	72 (24%)	161(54%)	137(46%)	87 (29%)	84 (28%)
Open/bare land	10(3%)	91(30%)	200(66%)	84 (28%)	75 (25%)	113(38%)

Source: Author's analysis 2019

Plate V and VI shows the commercial area showing the various activities happening in the study areas (Eke Awka market and Onitsha main market). These indicates that commercial activities have helped improve the rate of population growth in the study areas, bringing about urban growth. Seeing the crowd and movement in the plate v and vi, there is no doubt that there is a comparison with Table 4.15.

Plate V: Commercial activities in Eke Awka Market, Awka.
Source: Author's work 2019

Plate VI: Commercial activities in Onitsha.
Source: Author's work 2019

4.3.2.4 Consequences of increased population growth on land use in the area

There is no doubt an increase in population in the study area as illustrated in Table 4.15. There are subsequence consequences with an increasing population. Table 4.17 indicates that all the effects listed in the table correspond with the matter associated with increasing population in the study area.

About 28% respondents in Awka strongly agreed, 41% agrees corresponding with 41% respondents in Onitsha which strongly agreed and 36% that agrees that over – crowding is more common in the area. 23% respondents in Awka strongly agreed, 36% agrees corresponding with 23% respondents in Onitsha which strongly agreed and 36% that agrees that the houses are not properly planned. 43% respondents in Awka strongly agreed, 36% agrees corresponding with 38% respondents in Onitsha which strongly agreed and 29% that agrees that infrastructural such as electricity, health service good road are not properly planned. 30% respondents in Awka strongly agreed, 50% agrees corresponding with 28% respondents in Onitsha which strongly agreed and 41% that agrees that there has been high rate of people moving into the area. 14% respondents in Awka strongly agreed 50% agrees corresponding with 14% respondents in Onitsha which strongly agreed and 30% that agrees that Refuse is not properly dispose.

Table 4.16 Consequences of increased population growth on land use in the area

Question	SA		A		U		D		SD	
	Awka	Onitsha	Awka	Onitsha	Awka	Onitsha	Awka	Onitsha	Awka	Onitsha
Overcrowding is common	84 (28%)	129 (43%)	123 (41%)	107 (36%)	43 (14%)	25 (8%)	47 (16%)	25 (8%)	3 (1%)	9 (3%)
The houses are not properly planned	70 (23%)	69 (23%)	107 (36%)	107 (36%)	84 (28%)	51 (17%)	24 (8%)	58 (19%)	12 (4%)	3 (1%)
Infrastructure such as electricity, health services, good roads etc. are not properly managed	129 (43%)	114 (38%)	107 (36%)	87 (29%)	25 (8%)	22 (7%)	25 (8%)	61 (20%)	9 (3%)	12 (4%)
There has been high rate of people moving into my area	61 (20%)	84 (28%)	150 (50%)	123 (41%)	20 (7%)	43 (14%)	43 (14%)	47 (16%)	20 (7%)	3 (1%)
Refuse are properly dispose	43 (14%)	42 (14%)	150 (50%)	89 (30%)	61 (20%)	72 (24%)	20 (7%)	83 (28%)	20 (7%)	11 (4%)
Standard of living is high	47 (16%)	84 (28%)	123 (41%)	92 (31%)	43 (14%)	50 (17%)	84 (28%)	34 (11%)	3 (1%)	29 (10%)
Destruction of trees	180 (60%)	121 (40%)	48 (16%)	69 (23%)	8 (16%)	74 (25%)	5 (2%)	25 (8%)	24 (8%)	8 (3%)
There are water issues	23 (8%)	70 (23%)	182 (61%)	107 (36%)	38 (20%)	84 (28%)	23 (8%)	24 (8%)	20 (7%)	12 (4%)
Unemployment is on the increase	69 (23%)	180 (60%)	107 (36%)	48 (16%)	51 (17%)	28 (9%)	58 (19%)	5 (2%)	3 (1%)	24 (8%)

Source: Author's analysis 2019

4.3.3 LULC compliance with international standard for sustainable cities

4.3.3.1 Current status of house.

According to Table 4.17, 50% of the respondents from Awka agreed that house status in their area is perfect as compared to 52% from Onitsha. 9% agreed that there are dilapidated houses in their area as well as 4% respondents from Onitsha, 22% indicated that their houses need renovation in Awka and 23% in Onitsha. 7% of Awka respondents agreed that their houses require demolition while 6% from Onitsha agreed so. 8% of Awka respondents are of the opinion that their houses need redevelopment which 7% of Onitsha respondents agreed on too.

Table 4.17 Current status of house

Current house status	Awka	Onitsha
No response	14 (4%)	23 (8%)
Perfect	166 (50%)	182 (52%)
Dilapidated	30 (9%)	14 (4%)
Requires renovation	70 (22%)	80 (23%)
Requires demolition	23 (7%)	20 (6%)
Requires redevelopment	28 (8%)	23 (7%)
Total	**331 (100)**	**342 (100)**

Source: Author's analysis 2019

4.3.3.2 Condition of infrastructural facilities and services in the area

As illustrated in the Table 4.18, 16% of the respondents are of the opinion that the proximity of their area to health facilities is very good, 42% good, 27% fair, 1% bad

while 13% said it is very bad. On proximity to school(s), 24% very good, 49% good, 22% fair, 1% bad and 3% very bad. Proximity to police station and market, 12% and 36% very good, 18% and 28% good, 49% and 30% fair, 11% and 1% bad, 7% and 3% very bad. Access to portable water and electricity supply, 21% and 11% very good, 35% and 47% good, 38% and 32% fair, 4% and 4% bad, 3% very bad for each; Access to refuse disposal facilities, 10% very good, 26% good, 47% fair, 13% bad and 3% very bad.

Good drainage facilities, 14% very good, 26% good, 44% fair, 11% bad and 4% very bad. Access to good road networks and street light, 15% very good for each, 29% and 20% good, 37% and 34% fair, 14% and 20% bad, 4% and 10% very bad respectively. Safety and access to fire station, 25% and 10% very good, 27% and 14% good, 39% and 45% fair, 2% and 11% bad, 5% and 18% very bad respectively.

Table 4.18 Condition of infrastructural facilities and services in the area

Infrastructural facilities & services	VG	G	F	B	VB
Proximity to health facilities	48(16%)	126(42%)	81(27%)	2(1%)	38(13%)
Proximity to school(s)	71(24%)	147(49%)	67(22%)	4(1%)	8(3%)
Proximity to Police Station	36(12%)	54(18%)	147(49%)	33(11%)	22(7%)
Proximity to market	108(36%)	83(28%)	90(30%)	4(1%)	9(3%)
Access to potable water	62(21%)	106(35%)	113(38%)	11(4%)	8(3%)
Access to electricity supply	34(11%)	142(47)%	95(32%)	11(4%)	10(3%)
Access to refuse disposal/collection facilities	30(10%)	78(26%)	141(47%)	40(13%)	8(3%)
Good drainage facilities	41(14%)	78(26%)	131(44%)	34(11%)	13(4%)
Access to good road network	46(15%)	87(29%)	111(37%)	41(14%)	12(4%)
Availability of street light	44(15%)	60(20%)	101(34%)	61(20%)	31(10%)
Area is safe or secure generally	76(25%)	82(27%)	116(39%)	7(2%)	16(5%)
Access to fire station	29(10%)	43(14%)	136(45%)	34(11%)	55(18%)

Source: Author's analysis 2019

4.4 Appropriate Measure for Transforming the Area into a Sustainable Cities.

As shown in Table 4.19, for Awka 83% of the respondents recommended the planning of built up area (i.e. distinction of residential settlement from industrial center), 53% recommended the demolition and redevelopment of slum settlements, 74% want the provision of infrastructural services, 68% will appreciate a better access to educational facilities, 64% wants the use of energy efficient facilities, 81% wants the government to create economic zones to stimulate local economy, 68% recommended the creation of

green area and open space for recreational purpose and 81% wants the transportation system improved.

For Onitsha, 68% of the respondents recommended the planning of built up area (i.e. distinction of residential settlement from industrial center), 64% recommended the demolition and redevelopment of slum settlements, 81% want the provision of infrastructural services, 69% will appreciate a better access to educational facilities, 74% wants the use of energy efficient facilities, 53% wants the government to create economic zones to stimulate local economy, 74% recommended the creation of green area and open space for recreational purpose and 83% wants the transportation system improved.

Table 4.19 Respondent recommendation

S/N	Recommendation	Awka	Onitsha
1	Planning of built up area (distinction of residential settlement from industrial Centre)	249 (83%)	205 (68%)
2	Demolition and redevelopment of slum settlements	159 (53%)	192 (64%)
3	Provision of infrastructural services	221 (74%)	243 (81%)
4	Better Access to educational facilities	205(68%)	207 (69%)
5	Use of energy efficient facilities	192 (64%)	223 (74%)
6	Create economic zone to stimulate local economy	243 (81%)	159 (53%)
7	Creating green area and open space for recreational purpose	205 (68%)	221 (74%)
8	Improving transportation system	243 (81%)	249 (83%)
9	Others please mention below		Free education

Source: Author's analysis 2019

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Urban growth represents specific response to economic, demographic and environmental conditions in any geographical setting. In this study, an integrated approach of Remote Sensing and GIS was used for the evaluation of the growth of Awka and Onitsha and its impacts on its immediate environment.

The study observes that Awka as well as Onitsha has been growing rapidly. Apart from this, most of the residential buildings have been converted to commercial use in the core area of Onitsha thereby making the centre attractive to human and vehicular means of movement. Secondly, it observes that educational establishment is another driving force behind the growth of Awka. There is thus, the need for urban renewal strategy to manage the core areas as well as the periphery of these areas.

The population and built-up areas are growing rapidly while the rate of infrastructural provision is lagging behind. The developing areas are the worst hit while the core area suffers from overstress and dilapidation. This has implication not only on sanitary situation in the City but also on economic situation of the residents as judicious time is wasted queuing for water and repairing dilapidated infrastructures.

5.2 Recommendations

It could therefore be concluded that although urban development has positive some impacts on

livelihood strategies for some households, it also has negative impacts on other households. As

urban growth continues, economic activities also transform in response to urbanization. In light of the discoveries from the analysis, the accompanying recommendation are made

a) The study recommends that there should be regular monitoring of urban area using dynamic method such as Remote Sensing and Geographic Information System to provide current and accurate data for the urban mangers. Therefore, the urban managers should geo-informatics as a new tool for the purpose of monitoring and managing urban growth.
b) Anambra State ought to fortify the authorization limits of the Urban Development Board in the Local Government Areas with the command to checkmate and direct advancements, unlawful developments and the utilization of unacceptable structure materials.
c) All building plans endorsement in Awka as well as Onitsha ought to follow fair treatment and as per the Land use arrangement of the New Master Plan, to forestall erratic advancement and unlawful development without authorization or endorsement. The structures should have available streets, seepages and sufficient misfortunes inside the local locations for course, comfort and wellbeing reason
d) Rural – Urban Afforestation Projects ought to be reintroduced to supplant the lost vegetation. Tree planting ought to be empowered inside Residential, Commercial, Industrial, Institutions and Office premises, to diminish an Earth-wide temperature boost and advancing natural feel.

e) There is a need for the construction of vertical high-rise buildings to accommodate the growing population: As population increase, so does the need to provide houses increase too, but the conventional system of building single unit houses (bungalows) isn't sustainable. This is because population is constantly increasing and more land use is needed, so if we continue to build in this manner, other component of the environment could be destroyed.

f) The development control department should be awake to its responsibilities by checking change of use through constant, monitoring and demolition where necessary.

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APPENDIX 1

QUESTIONNAIRE
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA NIGER STATE
SCHOOL OF PHYSICAL SCIENCES
DEPARTMENT OF GEOGRAPHY

A COMPARATIVE STUDY OF URBAN EXPANSION AND ITS SOCIO-ECONOMIC IMPACT ON AWKA AND ONITSHA IN ANAMBRA STATE OF NIGERIA

Dear Respondent,

I am a master student of the above institution and department with the registration number of MTech/SPS/2018/7266. As part of the requirement for the award of M.Tech in Geography, i am currently undertaking a research work on the captured topic above. This questionnaire is aimed at gathering relevant information from resident in the study area. Information gathered will be used as data solely for academic purpose and will be treated with utmost confidence. For inquiries and further clarification please contact 07061027464. Thanks for your maximum cooperation.

SECTION A: Demography and General Information

Please kindly answer the questions on this section justly. For each of the following questions, you are required to tick appropriately the option that best represents your opinion.

a) State your location
b) Sex of the respondent (a) Male (b) Female
c) Age of respondent (a) 20-30 (b) 30-40 (c) 40-50 (d) 50-60 (e) 60 and Above
d) Tribe of respondent (a) Igbo (b) Hausa (c) Yoruba other, please specify
e) Marital status of respondent (a) Single (b) Married (c) Divorced (d) Widowed
f) Educational qualification (a) no formal education (b) Primary (c) Secondary (d) NCE/OND (e)HND/BSC (f) Post Graduate
g) Occupation of respondent (a) Trade (b) Farming (c) Civil servant (d) Retired (e) other, please specify
h) Do you reside in [Awka (a) Yes (b) No] [Onitsha (a) Yes (b) No]
i) If yes, how long have you resided in Awka/Onitsha (a)Less than 10years (b) 11-20years (c) 21-30years (d) 31-40years (e) 50years and above
j) If No, why did you move to Awka/Onitsha (a) Education (b)Employment (c) Trade (d) Agricultural practices (e) other, please specify

SECTION B: Resident perception on Land use Land cover Change

Questions in this section focus mainly on the perception of resident basically on the changes that have occurred in land use over the years in the study area.

Appropriate answer that suits each question should be tick.

a) Do you have an idea on what land use and cover change means (a) Yes (b) No

b) Which of the land use and land cover type dominates Awka/Onitsha 10years ago (a)Settlement (b)Farm land (c) Commercial land use (d)Forest/woodland (e)Water bodies (f)Bare land
c) Which of the following land use type currently dominates Awka/Onitsha (a)Settlement (b)Farm land (c)Commercial land use (d)Forest/woodland (e)Water bodies (f)Bare land
d) What is the current status of each land use? Tick as appropriate from the table below

Land use	Increased	Decreased	Neutral
From settlement			
Farmland			
Commercial			
Forest/vegetation			
Water bodies			
Open/bare land			

e) How will you rate land value per plot in Awka/Onitsha 20 years ago? (a) 100-1000 (b) 1000-2000 (c) 2000-3000 (d) 3000-4000 (e) 5000 Above
f) How will you rate land value per plot in Awka/Onitsha now (a) 100,000-300,000 (b) 300,000-500,000 (c) 500,000-800,000 (d) 800,000-1,000,000 (e)1,000,000 Above
g) What are the consequences of increased population growth on land use in the area? Please tick appropriately where Agree=A, Strongly Agree=SA, Undecided=U, Disagree= D, Strongly Disagree=SD

S/N	Question	SA	A	U	D	SD
1	Overcrowding is common					
2	The houses are properly planned					
3	Infrastructure such as electricity, health services, good roads etc. are properly managed					
4	There has been high rate of people moving into my area					
5	Refuse are properly dispose					
6	Standard of living is high					
7	Destruction of trees					
8	There are water issues					
9	Unemployment is on the increase					

SECTION C: Land use compliance with international standard of sustainable cities

Questions in this section are basically on how compliant is the study area with international standard of sustainable/Smart city. Kindly tick the appropriate answer the suits your area.

a) Do you own a land or a building in this area? (a) Yes (b) No
b) Do you have a certificate of occupancy for your land (Yes (b) No
c) Do you have a building permit for the current land use type (a) Yes (b) No
d) If yes, is the building in conformity with the land use type in the area (a) Yes (b) No
e) What is the current status of houses in your area (a) perfect (b) dilapidated (c) requires renovation (d) requires demolition (e) requires development
f) Are you connected to any infrastructure/ utility services in the area (a) Yes (b) No
g) If yes, do you pay utility bills for services render to your property (a) Yes (b) No
h) What are the condition of infrastructural facilities and services in your area:

NOTE: (VB = very good, G = good, F = fair, B = bad, VB = very bad)

S/N	Infrastructural facilities & services	VG	G	F	B	VB
1	Proximity to health facilities					
2	Proximity to school(s)					
3	Proximity to Police Station					
4	Proximity to market					
5	Access to potable water					
6	Access to electricity supply					
7	Access to refuse disposal/collection facilities					
8	Good drainage facilities					
9	Access to good road network					
10	Availability of street light					
11	Area is safe or secure generally					
12	Access to fire station					

SECTION D: Resident perception on recommendation towards reaching sustainable city

a) Do you have an idea of any land use master plan for improving the development of Awka/Onitsha (a) Yes (b) No

b) If yes, has the master plan been realistic in the improvement of Awka/Onitsha to a sustainable city (a) Yes (b) No

c) Are you satisfied with the current state of Awka/Onistha (a) Yes (b) No

d) If no, what will you recommend for the improvement and development of Awka/Onitsha? Tick the following options.

	Possible recommendation by respondent	Tick as appropriate
1	Planning of built up area (distinction of residential settlement from industrial Centre)	
2	Demolition and redevelopment of slum settlements	
3	Provision of infrastructural services	
4	Better Access to educational facilities	
5	Use of energy efficient facilities	
6	Create economic zone to stimulate local economy	
7	Creating green area and open space for recreational purpose	
8	Improving transportation system	
9	Others please mention below	