The Dynamics of Land use and Urban Sprawl in the Outskirts of Port Harcourt, Rivers State, Nigeria.

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ABSTRACT

The spread of the built-up region into suburban and rural areas is known as urban sprawl, and it has an impact on the local ecosystem and way of life. This study examined the dynamics of land use and urban sprawl in the outskirts of Port Harcourt, Rivers State, Nigeria. The study covered six local government areas in Rivers State: Oyigbo, Eleme, Etche, Okirika, Emohua, and Ikwerre, which are located near Port Harcourt. This study used both primary and secondary data sources which was carried out over a period of time. The primary data sets were gathered using multispectral Landsat photography. The photos for 2000, 2010, and 2021 were taken at a resolution of 30 meters using Landsat 5 TM, Landsat 7 ETM+, and Landsat 8 OTI/LIRS, respectively. 400 questionnaires were administered to Residents. Urbanization reduced the natural environment in Eleme LGA by 41.13% between 2000 and 2021, Emohua by 9.91%, Etche by 7.75%, Ikwerre by 13.13%, Okirika by 21.07%, and Oyibo by 41.13%, according to studies. Urban sprawl is attributed to a number of issues, including lower property values, improved infrastructure, growing living standards, a lack of urban planning, and a lack of legislation governing urban development. It was recommended that social amenities be provided in rural areas, that laws be implemented to ensure vertical growth as opposed to just horizontal expansion, and that agriculture—the main source of income for people living in rural areas—be made more lucrative.

Keywords: Urban Sprawl, Land Use Change, Urban Growth, Peri-Urban Development, Outskirt

INTRODUCTION

Development from the metropolitan areas has encroached on the rural areas as the world continues its fast-paced urbanization journey. "Urban sprawl" is the term used to describe urban expansion into rural areas. According to Gallster et al. (2001), urban sprawl is the quick growth of built-up areas and urban areas into the suburbs and rural areas. Low-density construction that consumes a lot of land is one of the factors contributing to urban sprawl. The utilization of these areas is disorganized. Staley (1999) and the U.S. General Accounting Office (1999) claim that any suburban growth could be characterized as "sprawling," particularly if it is unplanned.

Port Harcourt City has grown significantly since its founding, which has raised demand for and usage of land. Farmland and secondary woodland made up the majority of Port Harcourt's municipal area before 1918. The colonial administration created the urban area when Lord Lugard purchased roughly 25 square kilometers of land from the native Ikwerre and Okrika people in May 1913 (Brown & Wachukwu, 2015). In terms of physical scale, the city expanded from 15.54 square kilometers in 1914 to a metropolis spanning 360 square kilometers in the 1980s (Ede, Owei, & Obinna, 2010).

According to Weje and Wachukwu (2022), to improve the city, development plans for Port Harcourt were drawn in 1959 and later replaced by the 1975 Master plan. In 2009, the planning area was increased with the introduction of the Greater Port Harcourt City Development Authority Master Plan of 2008 which covered about eight (8) Local Government Areas (LGAs) on approximately 40,000 hectares of land with a projected population of 2 million people which cuts across Port Harcourt City, and parts of Oyigbo, Okrika, Ogu-Bolo, Obio/Akpor, Ikwerre, Etche and Eleme Local Government Areas (Weje & Wachukwu, 2022).

The growing population pressure and related anthropogenic activities have resulted in significant environmental stress and ecological instability, which has made the management of natural resources a pressing problem in recent times. A precise examination of the causes, processes, and rate of change in land use and land cover in

Port Harcourt and its surrounding areas is necessary due to the consequences of the natural and socioeconomic variables affecting land use and land cover in the city.

Urban population growth is the primary cause of the increased spatial expansion of built-up areas in most urban centers worldwide, leading to rapid and dynamic urbanization, particularly in developing nations (UNDESA, 2021). Urban land use and land cover changes are driven by considerable population growth from natural increase, migration to urban areas, and the conversion of rural areas into urban centers. Urbanization processes are not uniform throughout the world (Omodu et al., 2023, Ugwu et al., 2022, Elenwo & Ugwu, 2018, Melchiorri et al., 2018). This makes urbanization processes more dynamic in developing nations, which is concerning and unfavorable for sustainable urban development (Hegazy & Katop, 2015). This circumstance has presented urban planners with significant challenges.

AIM AND OBJECTIVES OF THE STUDY

This research aims to examine the extent of urban sprawl and land use changes within the rural-urban fringe area of Port Harcourt.

The objectives of the study are:

- Examine the land use change in the fringes of Port Harcourt for 21 years (2000 – 2021).
- Ascertain causes of urban sprawl within the rural-urban fringe areas of Port Harcourt.

Scope of the Study

The focus of this one-time study is to analyze the extent and causes of urban sprawl on land resources decline within the rural-urban fringe areas in selected LGAs in Greater Port Harcourt City. The Greater Port Harcourt City Master Plan is a holistic plan for the development of the Greater Port Harcourt City.

DESCRIPTION OF THE STUDY AREA

The historic city and its surrounding region make up the larger metropolitan area. Latitudes 6058´N to 706´N and longitudes 4040´E to 4055´E are where Greater Port Harcourt is situated (See figure 1). It is surrounded by mangrove swamp forests on the east, west, and south, and it is located nearly fully inside the lowland swamp forest ecological zone (Braide, Izonfur, Adiukwu, & Obunwo, 2004; & Chindah, 2004). With a population estimated to be about two million, Greater Port Harcourt spans eight Local Government Areas, namely Port Harcourt, Oyigbo, Okrika, Ogu–Bolo, Obio–Akpor, Ikwerre, Etche, and Eleme, and has an area of around 1,900 square kilometers (40,000 hectares).

Figure 1: Greater Port Area, in Rivers State.

Source: GPHCDA, Master Plan, 2008

LITERATURE REVIEW

Urban Growth Machine Theory

The founder of the urban growth machine theory is Molotch. It was first worked on by Molotch in 1976 (Molotch, 1976), and later in that same 1976 by Logan and Molotch. It emerged from the Chicago School of Urban Sociology and the Science field of community power studies (Logan & Molotch, 1976). Urban growth machine theory assumes that growth is been controlled by the elite group. Harvey Molotch's work is on how elites and entrepreneurs create the growth of a city. A coalition of actors and organizers share an interest in local growth since their actions affect land value, and compete with growth machines elsewhere for scarce mobile capacity investment, while simultaneously attempting to gain the tacit support of the local public for such growth (Rodgers, 2009). The elite groups are in Port Harcourt, and their land quest for various uses has caused urban sprawl. This quest has caused Port Harcourt to grow from a municipal area to a metropolitan area covering eight (8) local government areas in Rivers State.

The Concept of Urban Sprawl

Sprawl is mostly caused by urban expansion. Cities go outside their boundaries as they become larger. However, sprawl is more particular in that it refers to the unplanned development of a community without any true consideration for the effects of unfavorable environmental circumstances or the environment. Urban sprawl is described by Gordon and Richardson (1997) as "leapfrog development."

The causes of urban sprawl vary from place to place. In a nutshell, causes of sprawl include population growth, independence of decision, economic growth, industrialization, speculation, expectations of land appreciation, land hunger attitude, legal disputes, physical geography, development and property tax, living and property cost, lack of affordable housing, the demand of more living space, public regulation, transportation, road width, single-family home, nucleus family, credit and capital market, Government developmental policies, lack of proper planning policies, failure to enforce planning policies, country-living desire, housing investment, large lot size (Bhatta, 2010).

Empirical Review

Agbora and Weje (2019) conducted a comparable study in Bori, Nigeria's Rivers State. The purpose of the research was to determine if land use changes in the Bori expansion region complied with the 1972 Bori Master Plan. The study employed a longitudinal survey approach, obtaining and analyzing images from 2003 and 2018. The analysis found that while residential land usage expanded from 1,302.7 Ha in 1972 to 5,302.7 Ha in 2003 and 7,507.3 Ha in 2018, correspondingly, the development of Bori deviates from the master plan's provisions. From 144.8 Ha in 1972 to 1,117.3 Ha in 2018, the amount of land used for commercial purposes increased. In 1972, the natural environment accounted for 65.4% of the land area of Bori; by 2018, that percentage had reduced to 7.3%. A review of the Bori master plan and its execution was suggested by the research.

The geographical structure of urban sprawl in Jos, Plateau state, was examined by Mairiga et al. (2023) between 2002 and 2022. The study examined the geographical structure of the sprawl using GIS mapping, land cover change analysis, density sprawl, neighborhood statistics, and cross-change detection tools. The study's conclusions show that between 2002 and 2022, the settlement area grew from 125.45 square kilometers to 208.16 square kilometers. A further 3.33 square kilometers of water bodies and 127.57 square kilometers of open space land use were converted to habitation. The study blamed urban sprawl for this kind of increase.

In Lokoja, Nigeria, Alabi (2009) studied the pattern and quantification of urban sprawl. The study applied Shannon's entropy theory to evaluate the behavior of sprawl and employed GIS tools to acquire local records for the years 1987–2007. The results demonstrated a relationship between entropy levels and population density. The main thoroughfares that go through Lokoja are seeing expansion. Along the workers' community and tapering along the Kabba-Okene road are the new development zones. The study also pointed out that there has been significant recent growth near the Ganaja-Ajaokuta route, where several privately held and government-owned estates have appeared.

Urban sprawl in Abuja was investigated by Aniekwe and Igu (2019). Nine variables were used to show how sprawl affects the ecosystem, while 14 variables were used to indicate the causes of sprawl. The study's conclusions show that population growth was the primary cause of sprawl, with other consequences including increased crime, pollution, land degradation, loss of biodiversity, and a high dependence on cars. To stop urban sprawl, the research suggested following urban planning guidelines.

Bruegmann (2005) examined Sprawl: A Brief History in America. The study concludes that the primary causes of urban sprawl are reclusive lifestyles and the desire for large, separate houses with gardens that are in touch with the natural world. Nechyba and Walsh (2004) also mentioned the role racism plays in America's urban sprawl. Brody (2013) listed the following factors as contributors to the United States' expansive development: land value, population expansion, growing affluence, falling transportation costs, racial tension, aging, and preference for larger lots.

METHODOLOGY

The research used a longitudinal survey research design. It was carried out in situ at one point in time. The study made use of both primary and secondary sources of data. The primary data are multispectral Landsat imageries, of 2000, 2010, and 2021 respectively. These imageries (Landsat 5 TM, Landsat 7 ETM+, and Landsat 8 OTI/LIRS) were acquired respectively freely online from the site GLCF website with a resolution of 30m. The use of 400 questionnaires which were distributed and retrieved from residents of the urban fringes of Port Harcourt using simple random sampling aided in ascertaining the causes of urban sprawl in Port Harcourt.

RESULTS AND DISCUSSIONS

Land Use Changes Due to Urban Sprawl

The land area of Eleme Local Government Area is around 13,783.24 Ha. In 2000, vegetation occupied 76.26% of the area, while the developed environment covered barely 3,272.72, or 23.74%. 2010 saw an increase in the built environment of 11.66%, resulting in 4,880.32Ha of land (or 35.41% of the total land area). The built environment grew by an additional 28.03% in 2021. As of 2021, vegetation covered 5,039.55Ha, or 36.56% of the total land area, while the built environment covered 8,743.69Ha, or 63.44% of the total land (See Table 1).

The loss of vegetation in the Emohua local government area is not tremendous. Out of 83,156.56Ha of the total land area, in 2010 the built environment covered only 3.08% while the vegetation covered 96.92%; in the year 2010, the built environment covered 5.74% while the vegetation covered 94.26%; in the year 2021, the built environment covered 12.99% while the vegetation covered 87.009% of the total land area. Emohua local government area has a slight change of less than 10% over the years.

Etche has a total of 80,438.37Ha of land. In the year 2000, Etche LGA lost 4.01% of the total area to urban sprawl. In 2010, the local government lost an additional 2.93% to the built environment making the vegetation cover 74,857.24Ha. In the year 2021, Etche lost an additional 4.821% of its vegetation cover to the built environment, leaving the total vegetation cover at 70,979.91Ha.

Ikwerre local government area has a total of 65,666.67Ha of land. In the year 2000, vegetation in Ikwerre LGA covered 96.34% (63,261.69Ha) of the total land area. In the year 2010, the green area of Ikwerre reduced slightly to 61,185.57H, and in 2021, the reduction in the vegetation area of Ikwerre became obvious as it dropped to 54,642.97Ha which is 83.21% of the total area as against 96.34% in the year 2000.

Okirika has experienced a tremendous loss of natural envirnment due to urban sprawl, especially between 2010 and 2021. The LGA has a total of 22,507.01Ha of land. The natural environment of the LGA covered 89.78% of the total land area in the year 2000; but in 2010, it reduced to 85.41%. In 2021, the natural environment covered just 68.71% of the total land area of the LGA. By implication, from 22,507.01Ha in 2000 to 19,223.24Ha in 2010, then to 15,464.93Ha in 2021.

Despite having a total size of 25,184.08 Ha, the built environment has taken away nearly half of the greenery in the Oyigbo local government region. The vegetation of Oyigbo covered 22,139.55 Ha (87.91% of the total land area) in the year 2000. By 2010, the vegetation had fallen to 20,676.60 Ha (82.10% of the total land area); by 2021, it had further declined to 11,782.14 Ha (46.78% of the total land area). Oyigbo lost over 36% of its greenery to the built environment between 2010 and 2021; this loss can be attributed to urban expansion.

Table 1: Land Use Changes Due to Urban Sprawl

LGA	2000	%	2010	%	2021	%
Eleme	3,272.72Ha	23.74	4,880.32Ha	35.41	8,743.69Ha	63.44
Emohua	2,562.25Ha	3.08	4,774.97Ha	5.74	10,802.75Ha	12.99
Etche	3,226.23Ha	4.01	5,581.14Ha	6.93	9,458.46Ha	11.76
Ikwerre	2,404.98Ha	3.66	4,481.10Ha	6.82	11,023.70Ha	16.79
Okrika	2,300.91Ha	10.22	3,283.77Ha	14.59	7,042.08Ha	31.29
Oyigbo	3,044.52Ha	12.09	4,507.47Ha	17.90	13,401.94Ha	53.22

Source: Researchers' Field Survey (2022)

Generally, Oyigbo LGA has lost more of its natural environment to urban sprawl. The LGA lost 5.81% between 2000 to 2010 as indicated in Table 2, the surge came between 2010 to 2021 when 35.32% of the natural environment was lost to the built environment thereby making it a total of 10,357.42Ha representing 41.13% of its total land lost to urban sprawl.

Eleme LGA is second to Oyigbo LGA in terms of a general loss of natural environment to the built environment. From 2000 to 2010, Eleme was losing more of the natural environment (11.67%) than other LGAs. From 2010 to 2021, it lost more than 28.03% making it a total of 39.70% (5,470.09Ha) of natural environment lost to urban encroachment.

Okrika is third in the rank of LGAs that have lost rural enclaves to urban form. From 2000 to 2010, the LGA lost 982.86Ha representing 4.37% of its total land area to the man-made environment. The LGA further lost 3,758.31Ha representing more than 16.70%, making it a total of 21.07% of its natural environment lost to urban sprawl.

Ikwerre, Emohua, and Etche LGAs have lost a total of 8,618.72Ha (13.13%), 8,340.75Ha (9.91%), and 6,232.23Ha (7.75%) respectively to the man-made environment as a result of urban sprawl.

Table 2: Land Conversion Over the Years Due to Urban Sprawl

LGA	2000 - 2010	%	2010 – 2021	%	Rank
Oyigbo	1,462.95Ha	5.81	8,894.47Ha	35.32	1st
Eleme	1,607.60Ha	11.67	3,863.37Ha	28.03	2nd
Okrika	982.86Ha	4.37	3.758.31Ha	16.70	3rd
Ikwerre	2,076.12Ha	3.16	6,542.60Ha	9.97	4th
Emohua	2,212.72Ha	2.66	6,027.78Ha	7.25	5th
Etche	2,354.91Ha	2.92	3,877.32Ha	4.83	6th

Source: Researchers' Field Survey (2022)

The urban fringes of Port Harcourt have suffered the loss of vegetation to urban sprawl. Figure 2 clearly illustrates the land use cover change. It shows there was a rapid expansion of land use cover in all the six (6) Local Government Areas of the State studied. Urban growth and expansion are generally the result of large-scale settlement development that takes place amidst informal governmental land use constraints.
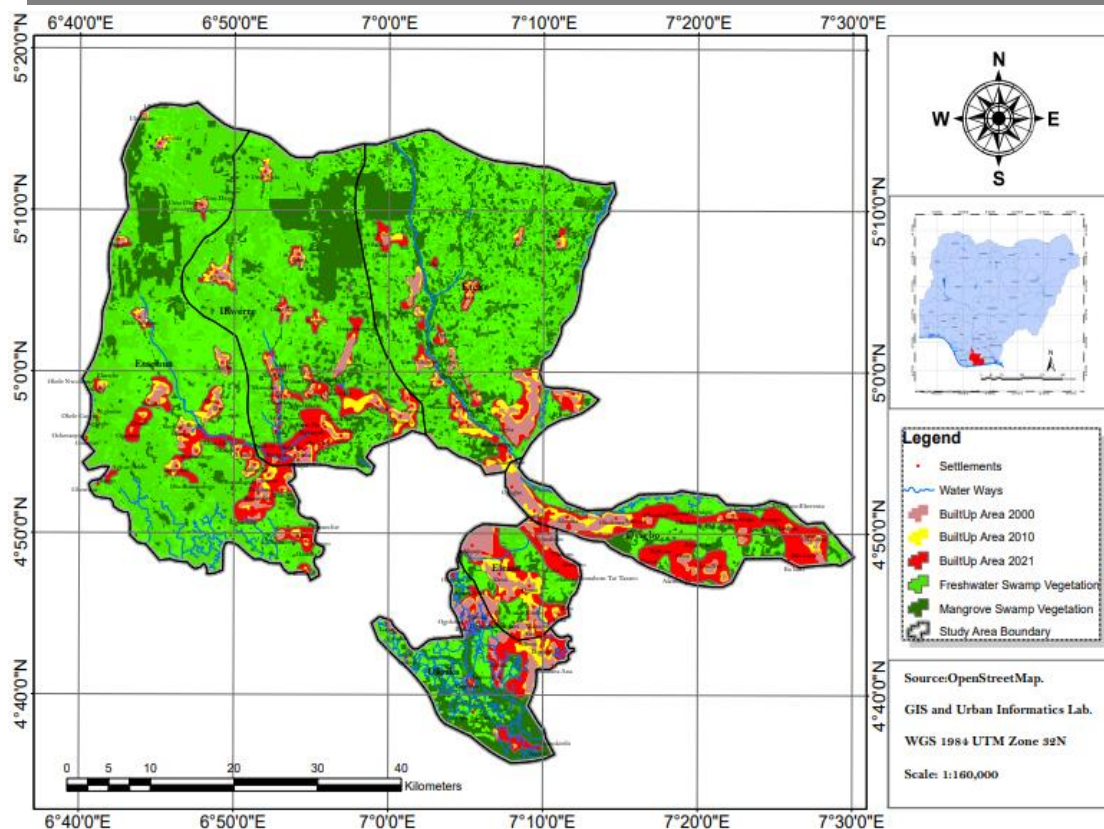
Figure 2: Extent of urban sprawl on Eleme, Emohua, Etche, Ikwerre, Okirika and Oyigbo

Source: Researchers' Field Survey (2022)

Major Causes of Urban Sprawl within the Fringes of Port Harcourt

Lower land value, better infrastructure, an increase in living standards, a lack of urban planning, and a lack of regulations governing urban planning are major contributors to urban sprawl, as seen in figures 3 to 6. Urban sprawl and population increase are caused by certain reasons. These include migration from rural to urban areas, rising household incomes, advantageous topography, the local economy, uneven spatial development, regional development, the availability of natural resources, planning policies, poverty, and an emphasis on horizontal spread as opposed to vertical high-rise growth. Out of 400 persons who responded, 284 persons which constitute 71.0% of the respondents agree that lower land value is the major cause of urban sprawl, and 23.0% strongly agree to that. But 0.5% said they disagree and 5.5% said they strongly disagree.
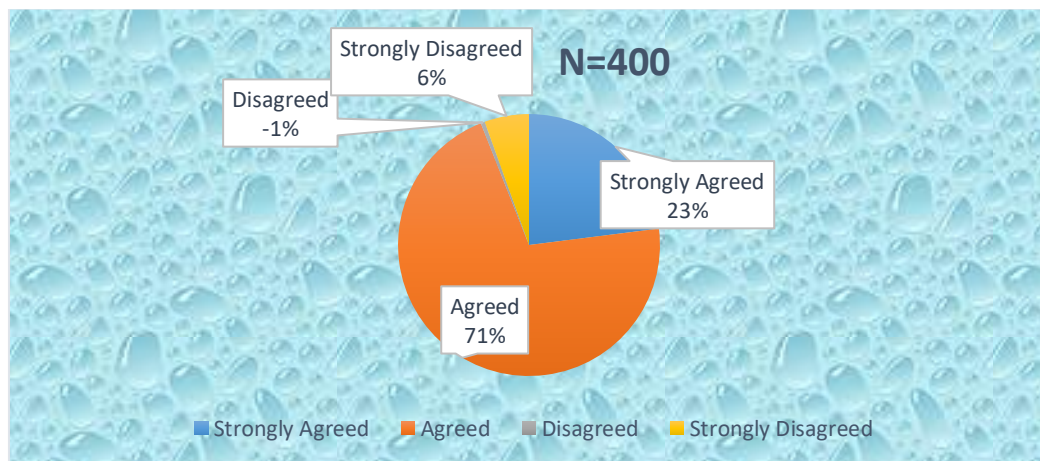
Figure 3: Lower Land Value as a Major Cause of Urban Sprawl

Source: Researchers' Field Survey (2022)

According to Figure 4, most respondents (60.3%) agree that improved infrastructure caused urban sprawl, and 3.8% said they strongly agreed that improved infrastructure caused urban sprawl. 0.8% said they disagree and 35.3% said they strongly disagree.
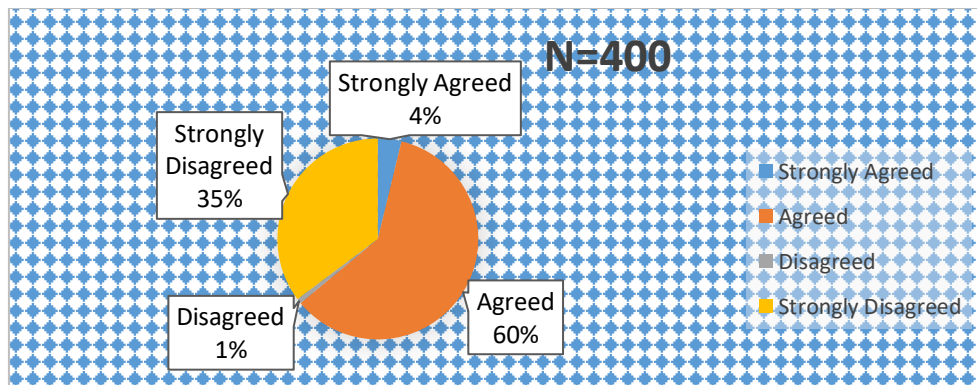

Figure 4: Improved Infrastructure as a Major Cause of Urban Sprawl

The majority of respondents (260, or 65.0%) concur that rising living standards are a contributing factor to urban sprawl, and 31.3% strongly concur. However, 1.0% strongly disagree and 2.5% disagree that urban sprawl was caused by an increase in living standards.
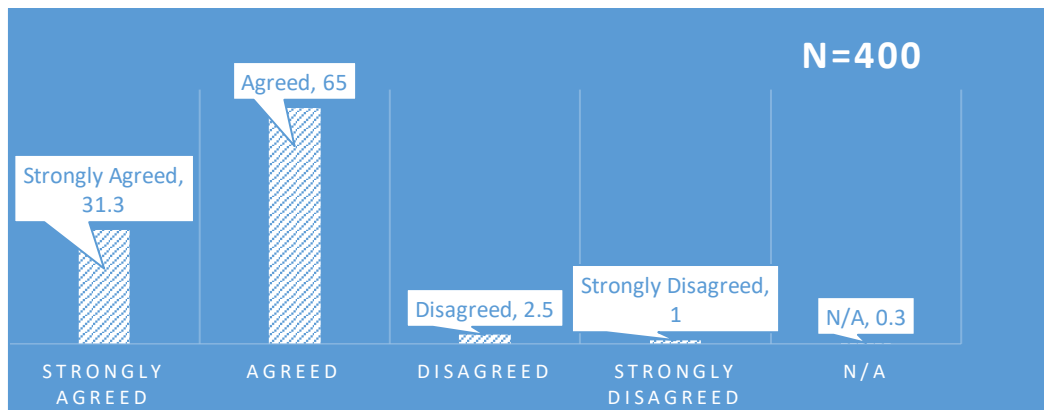
Figure 5: Rise in Standard of Living as a Major Cause of Urban Sprawl

Source: Researchers' Field Survey (2022)

All respondents are of the view that lack of planning causes urban sprawl with 271 respondents representing 67.8% agreeing to that and 129 respondents representing 32.3% strongly agreeing (See Figure 6).
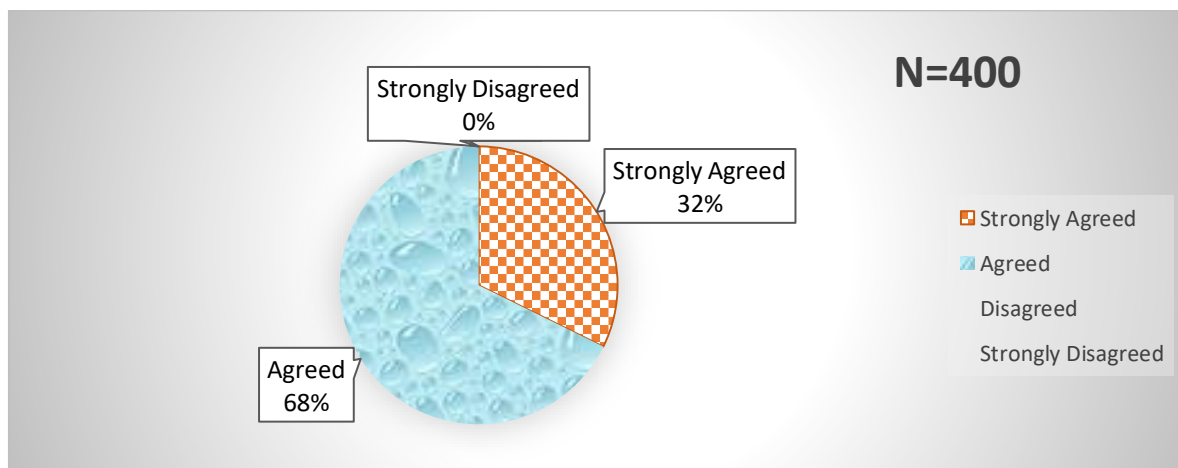

Figure 6: Lack of Urban Planning as a Major Cause of Urban Sprawl

Source: Researchers' Field Survey (2022)

CONCLUSION/RECOMMENDATION

This research has deciphered the extent of urban sprawl and land resource decline within the identified urban fringes of Port Harcourt. The empirical review by Agbora and Weje (2019), Mairiga et al. (2003), and Alabi (2009) and this research indicate rapid loss of natural environment to the built environment, a clear indication of the presence of urban sprawl. In line with the objectives of this research, lower land value, improved family income, improved infrastructure, rise in the standard of living, lower house tax, population, etc. are factors responsible for urban sprawl, these also justify the previous research of Aniekwe and Igu (2019), Brody (2013), Bruegmann (2015).

Critical analysis of the objectives and findings of this research led to the emergence of the following recommendations:

- Social amenities should be provided in the rural areas so as to curb the issue of mass exodus from the rural areas to Port Harcourt.
- Agriculture which is the basic occupation of the rural dwellers should be made more lucrative.
- Policies to ensure vertical growth rather than just horizontal growth should be formulated and implemented.
- The Port Harcourt master plan should be reviewed or the Greater Port Harcourt master plan should be fully implemented so as to curb the issue of lower tax rate, regulate urban planning and promote laws to govern growth and development of Port Harcourt and its fringes.
- There should be laws/implementations of laws on conservation and preservation of special areas.

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