

## INVESTIGATING TREND IN LAND USE CHANGE IN AKURE CITY CORE BETWEEN 1993-2023

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### Abstract

*The research examined the trend in land use changes within the last 30years (1993 – 2023) from a decade and half when the State was created. Data were gathered through structured questionnaires distributed to 220 property owners and tenants in the study zone, as well as 25 active Estate Surveying and Valuation firms in Akure, as identified in the Nigerian Institution of Estate Surveyors and Valuers directory for the year 2022. Data were also collected from satellite imageries available on the USGS website covering various dates within the period in consideration. The data collected were analyzed using descriptive statistics (frequency distribution tables and arithmetic mean) and inferential statistics (Kruskal-Wallis H test), satellite imageries, remote sensing techniques, GIS and maps were used. The result of the study revealed that while residential land use continues to decline within the time period, commercial land use is on the increase and dominates among all other land uses in the study area. Its transformation from residential uses reveals a pull down and redevelopment pattern among others such as change of use, alteration and conversion. Kruskal-Wallis H Test revealed that there is no statistically significant difference in the choice of patterns of land transformation among the three independent respondents; it was recommended that the planning agency should plan ahead to control and accommodate the growth of the city core.*

**Key Words:** Land, Land Use Change, Land Administration, Geographical Information System, Remote Sensing, Land Policy, Land Use Pattern, Redevelopment

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### Introduction

Urban land use change is one of the major driving forces of global environmental change (Akinluyi *et al.*, 2021), as changes in urban land use in any society are inevitable irrespective of the genesis and nature of the changes because they are all part of urban growth. Land use

denotes how man uses the biophysical or ecological properties of land. Land use varies from one area to another based on the use and employment by man (Austine *et al.*, 2016). The use of land such as modification and/or management of land for agriculture, settlement and forestry amongst others are basis for urban

transformation and growth. However, the pace, magnitude and spatial reach of man's alteration through land use changes are unprecedented.

Oluseyi (2006) noted that urban land uses since time immemorial and especially since the urban explosion of the 1970s had been increasingly subjected to changes of different forms, sorts and types which was majorly as a result of mass migration and people to cities in anticipation to benefit from urban economy. However, most Nigerian cities are not adequately planned for urban expansions and transformations which therefore results in the decadence witnessed in these cities. Verma (2008) and Javaid *et al.*, (2013) noted that cities have an image, and most cities continue to change as a result of urbanization and expansion which thus affects the image of such cities.

The changing structure of the city is also causing a loss to residential architectural heritage and disregard for customary tenure system, especially what is generally known as legacy from the ancestors. Adedeji (2008) noted that the large majority of cultural, residential, traditional buildings and monuments preserved by the communities that have transformed into urban areas, especially at the city centres are fast going into extinction and giving way to the new wave of development that has characterized urbanization. There has been a phenomenal growth of urbanization resulting in our major cities growing and expanding in an unplanned manner; this is a notable feature of many Nigerian cities. Owuoye and Ibitoye (2016) noted that expansion and land use changes in Akure have resulted in the deterioration of the environment due to incompatible land use

pattern which is often caused by urbanization, housing development, agriculture, population growth, land consumption rate, local climate amongst others. The core of most cities is decaying and increasingly becoming slums (Aluko, 2011).

Owuoye (2013) noted that City centres have the greatest concentration of the poor and the illiterates with inadequate means of livelihood occasioned by breakdown of amenities. As a result, solid and liquid waste that are improperly disposed serve as breeding ground for pests and diseases hence, lowering the environmental habitability of city centres. According to Adegunle *et al.*, (2016) land use changes are attributable to human population explosion which culminates into uncontrollable intense use of land and in turn urban transformation and imbalance in socio-economic human activities. Adefioye (2013) also noted that land use changes occur abruptly without adequate consideration for future developments. More noticeable in the case study area is the conversion of residential use to commercial use especially at the city core which has drastically changed the land use pattern of the area. The aim of this paper, therefore, is to investigate the trend in land use change in Akure city core in the past three decades with a view to generating the predictive model for managing the future trend and their possible effects.

## **Literature Review**

Studies about land use change continue to expand widely because it affects urban progress as well as ecological sustainability alongside social and economic frameworks. Scholars have conducted comprehensive investigations on factors that affect land use transitions

primarily because of population growth and economic activities as well as policy practices and spatial analysis technology developments. During the last thirty years urbanization worldwide has grown rapidly thus affecting ecological systems together with infrastructure management and social-economic processes. Various investigations across the world have explored the characteristics and causes together with the impact of these changes by utilizing geospatial tools and remote sensing platforms with specific case study findings. The research focuses mainly on the land use changes occurring in Akure Nigeria yet incorporates learnings from other urban regions to establish comparative understandings.

Studies about land use changes verified urbanization as a central driver for such modifications. According to Angel *et al.* (2011) cities around the world are experiencing unmatched growth which results in numerous rural areas being turned into urban spaces. Cities in developing nations demonstrate apparent urban sprawl because of increasing population and expanding economic zones. The quick growth of urban areas in Africa led to land use style changes from typical patterns that now include diversified zones of residential areas combined with commercial and industrial development (Idowu and Ajibade, 2024). Analyses have shown these changes produce vital implications for sustainable urban planning because they lead to transportation problems, insufficient housing stock, unauthorized settlements and ecological deterioration (Jooste *et al.*, 2019).

Scholarly research about urban growth and its effect on land use patterns exists for major Nigerian cities including Lagos,

Ibadan, Abuja and Port Harcourt. By using Landsat imagery along with GIS techniques Abiodun *et al.* (2011) studied the land use evolution of Lagos from 1984 to 2005. Rapid urbanization showed itself through substantial built-up area expansion that reduced vegetation and open spaces. Mmom and Fred-Nwagwu (2013) researched Port Harcourt land use modifications between 1986 and 2007 through their investigation which showed urban growth caused the removal of agricultural land and natural vegetation like global urbanization does. The findings show land modification phenomena are widespread beyond Akure because they influence numerous urban centres throughout Nigeria and throughout the globe.

Different researchers have studied the way Akure has evolved its land use patterns throughout history. Asaju and Olukolajo (2023) applied multispectral Landsat imagery to study complete land cover transitions from 2011 to 2022. The research indicates that built-up areas dramatically increased from 20.15% to 71.45% as green spaces decreased from 43.43% to 14.78%. The research conducted by Ibitoye (2019) found that Akure's Ala River catchment area experienced 31 years of growing urban development alongside decreasing vegetation cover. These research investigations demonstrate how urban growth has greatly encroached on previously undeveloped areas because of population increases together with real estate development activities and infrastructure projects.

Land use change functions as one of the essential drivers because of economic development. Urban areas operate as economic command centres that bring

investment flows which result in modifications of spatial arrangements. Nuissl and Siedentop (2021), observe that quick economic changes within cities lead to enhanced land alteration which results from manufacturing zones combined with commercial zones and residential developments transforming urban structures. Real estate investments in Akure serve as the leading factor in land management modifications through developer acquisitions for commercial buildings and high-density residential zone development. Study results from Nairobi Kenya demonstrate that land valuation increases through speculation have turned previous peri-urban areas into residential and commerce districts (Cheloti and Mooya, 2023).

Land use transformation requires the essential function of policy and governance frameworks for management purposes. The directions of land development come from urban planning documents together with zoning rules and environmental management guidelines. Because of insufficient planning regulation enforcement across African cities there exist uncontrolled land use changes that produce unplanned settlements with significant infrastructural gaps (Azu, 2014). Akure faces challenges because its land use policies cannot adequately adapt to the speed of urban development. The study by the World Bank. (2017) demonstrates how insufficient regulatory oversight allows informal land transactions to block sustainable land management strategy applications. The governmental attempts to control the growth of informal settlements in cities like Jakarta and Mumbai have proven unsuccessful as

these districts continue their expansion (McGranahan and Martine, 2014).

The successful analysis of land use transformations depends on the researcher's use of geospatial technology consisting of remote sensing alongside Geographic Information Systems (GIS). The available tools enable users to measure changes in land use while providing exact geographic positions through a quantitative spatial system over periods. Lu *et al.* (2004) categorised the change detection studies into algebra-based techniques, transformation methods, classification approaches, and GIS-based modelling. Advanced remote sensing technology now achieves higher classification accuracy and machine learning algorithms aid remote sensing change detection (Mashala *et al.*, 2022). The application of GIS in Nigeria proves essential for land use assessment by performing supervised classification and Normalized Difference Vegetation Index (NDVI) analysis with spatial modelling to monitor urban growth and environmental deterioration (Olokeogun *et al.*, 2014).

Various hurdles remain unsolved in the field of land use research even though advancement has been achieved. The main obstacle behind successful land use research arises from limited and unreliable data access. Developing countries encounter obstacles when trying to obtain high-resolution satellite images because these images are expensive to access. The quality of image classification for land cover analysis is influenced by atmospheric conditions and seasonal variations which results in assessment discrepancies (Hansen *et al.*, 2013). Extended urban land use configurations create complications for researchers since their analysis faces issues in the precise

labelling of blended operational categories from multi-functional areas.

At last, land change is an unwieldy topic related to urbanization, economic growth, policy framework and technological evolution. Patterns and drivers of land transformation must be studied from other parts of the world in circumstances like Akure, where other important contextual factors have to be taken. Basis of remote sensing and GIS has contributed to integrated monitoring and prediction of the land use trend, but the problem of the lack of data and the remaining error in jurisdictions still exists. To overcome these problems a multi-disciplinary approach should be adopted combining urban planning, built environment, environmental management and technological innovation to ensure that sustainable land use practice is taken into effect. Further research might be directed toward the availability of data, improvement of the change detection techniques, and the design of policy interventions that ensure urban growth is in simultaneous concert with environmental conservation.

#### **Study Area**

Akure lies between latitude  $7.1824^{\circ}$  and  $7.3068^{\circ}$  north of the equator and longitude  $5.1249^{\circ}$  and  $5.2506^{\circ}$  east of the Meridian. It is about 700 km Southwest of Abuja and 311 km north of Lagos State. Akure is located in south-western Nigeria. The climate is hot and humid, influenced by rain-bearing southwest

monsoon winds from the ocean and dry northwest winds from the Sahara Desert. The rainy season lasts from April to October, with rainfall of about 1524mm per year. Temperatures vary from  $28^{\circ}\text{C}$  to  $31^{\circ}\text{C}$  with mean annual relative humidity of about 80% (BBC- Weather Centre). It has an area of about 15,500  $\text{km}^2$  and it is about 370m above the sea level, is situated within a 48kilometer radius to major towns in Ondo State, viz Ondo to the South, Owo to the East and Iju/Itaogbolu to the North. Easy access and geographical centrality of Akure to these towns have enhanced the growth prospects of the city. Akure township is located in Akure South Local Government Area. The population of the city grew from 38,852 in 1952 to 71,106 in 1963. Its population was estimated to be 112,850 in 1990. The National Population Census (NPC) puts the population of Akure at 239,124 and 353,211 based on the 1991 and 2006 census respectively. Akure, as a capital city, is experiencing economic growth which is evident in all the sectors. Investors have been diverting their fund into property development especially conversion of residential uses to commercial uses within the city which are majorly noticed around Arakale and Oba-Adesida road and this was due to the profitability of the market. This land use change has increased the commercial activities of the area and in turn have positive impact on the property value.

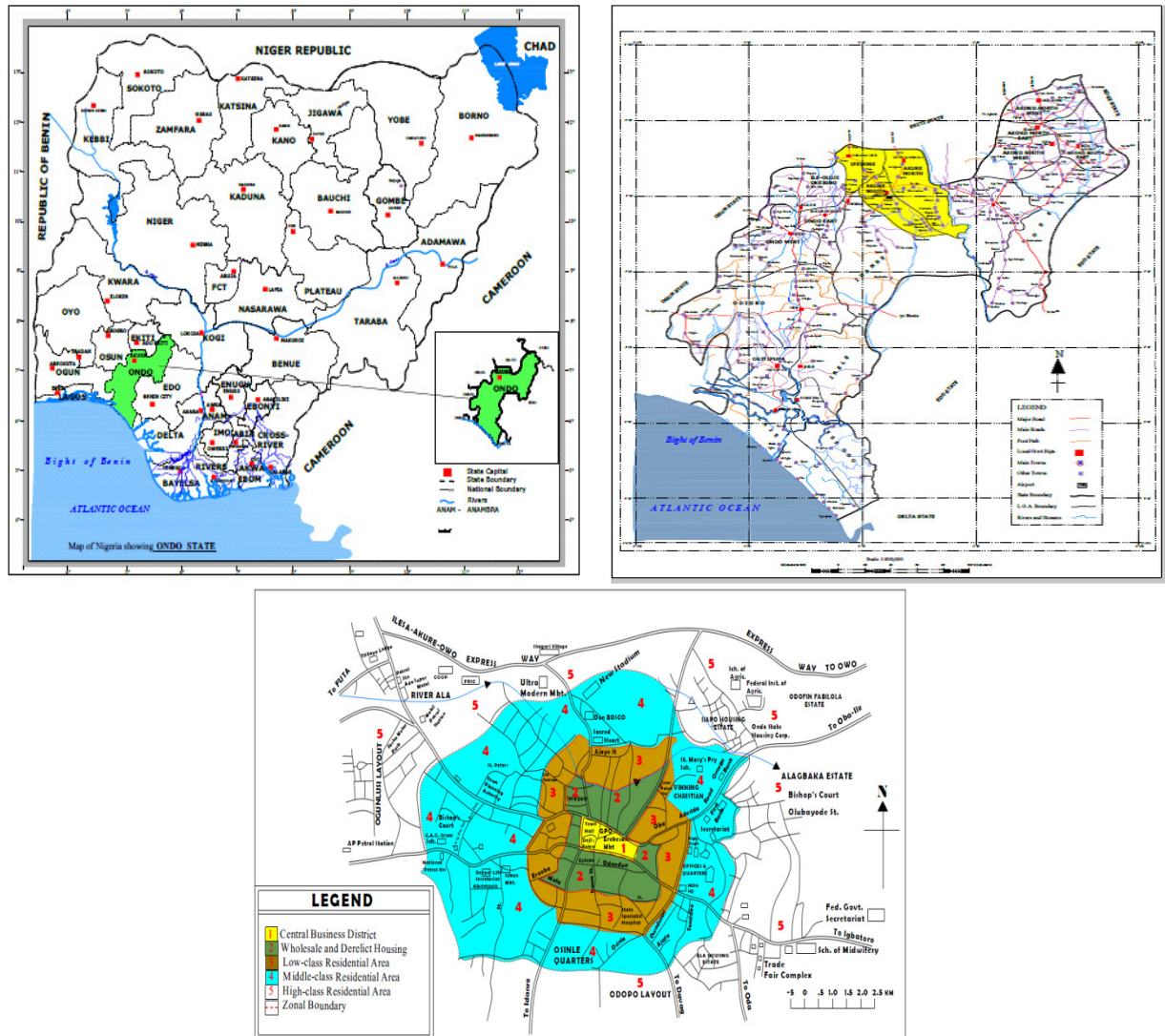


Fig. 1. Map of Nigeria showing the location of Ondo State and showing Akure South LGA  
Source: Ministry of Works, Lands and Housing, 2020

## Methods

### Data Collection

This study employed a mixed-methods research design, targeting the occupiers and owners of properties in the selected areas as well as the practicing estate surveying and valuation firms in Akure, given their roles as property managers and their awareness of land use changes and conversions. The study adopted a total census approach, in line with Israel (2002) recommendation that it is appropriate for

small populations. Purposive sampling was adopted to encompass the entire target population.

Structured self-administered questionnaire was designed and employed to collect necessary data for addressing the study's objectives. The data collected were analysed using frequency tables, weighted mean score, Kruskal Wallis H test, as well as Landsat imagery and Google earth imagery.

Data collected for the study were primary data from the owners /occupiers of properties in the selected areas, the practicing Estate Surveying and Valuation firms in Akure because they are managers of the properties and are aware of land use changes.

### ***Questionnaire Distribution***

During the research, data collected for the study were through questionnaires administered to the target population that comprised owners /occupants of properties in the selected areas and practicing Estate Surveying and Valuation firms in Akure. The results were analyzed and presented in Table 1.

**Table 1: Number of Questionnaires Administered and Retrieved**

Respondents	Area	Number distributed	Number Retrieved	Percent
Owners/ Occupants	Oba-Adesida Road	102	91	89.21
	Arakale Road	118	104	88.14
Estate Surveying and Valuation firms in Akure.		32	22	68.75
<i>Total</i>		<i>252</i>	<i>217</i>	<i>86.11</i>

Table 1 shows that 102 and 118 questionnaires were distributed to the owners /occupants of properties in the selected areas of Akure consisting of Oba-Adesida Road and Arakale Road, respectively. Copies of the questionnaire retrieved were 91(89.21%) for Oba-Adesida Road and 104 (88.14%) for Arakale Road. Twenty-two (22) copies of the questionnaire out of the thirty-two (32) copies administered to the practicing Estate Surveying and Valuation firms in Akure were also retrieved, representing 68.75%.

Generally, 217 (86.11%) out of the 252 total administered questionnaires on the target populations were retrieved. This suggests a high response percentage, thus giving sound footing for further analysis.

### **Result and Discussion**

#### ***Trend in Land Use Change at Akure City Core between 1993-2023***

In examining the trend in land use changes along the selected areas in Akure, the research through land use maps examined the various land use analysis based on the study for a period spanning thirty (30) years. Remote sensing and GIS techniques were used and data presented using maps. The maps for the years 1993, 2002, 2012 and 2023 have thus been provided to ascertain the trend in land use changes over the years. Thereafter, the nature and pattern of the predominant land use change were analyzed.



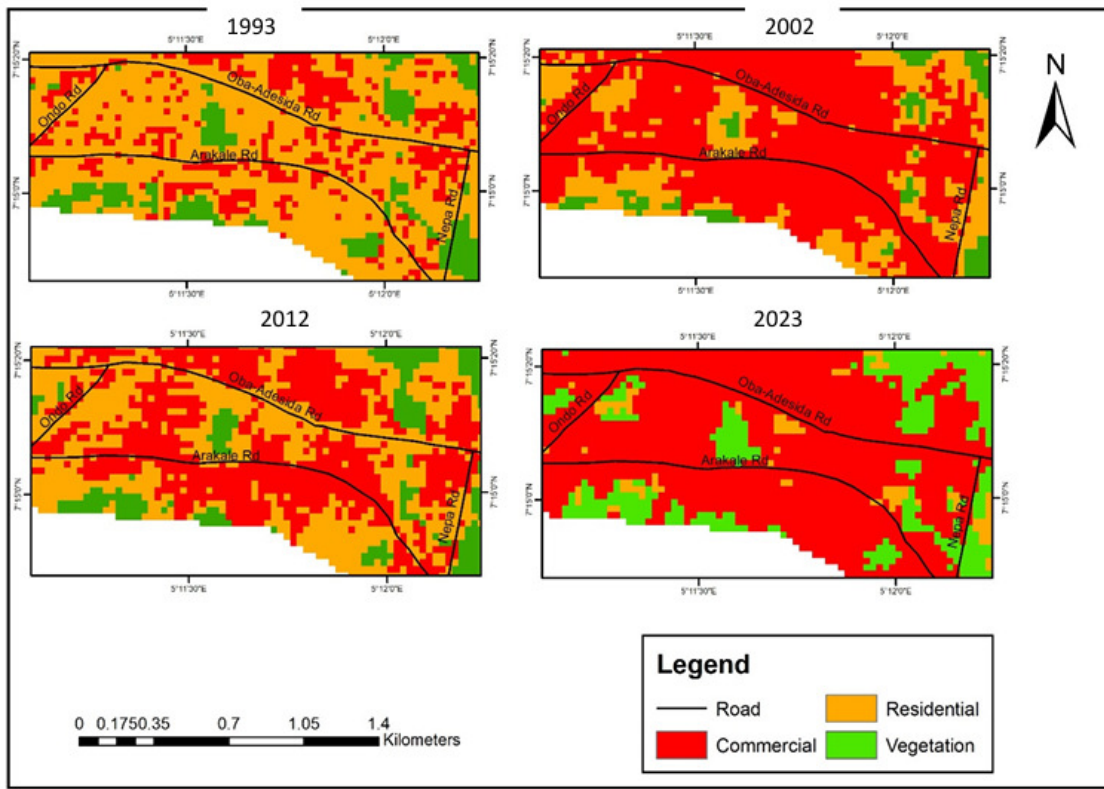


Fig. 2: Landuse Map of CBD for 1993, 2002, 2012 and 2023

The area covered by the various classes of land uses in the Central Business Districts which majorly consists of Oba Adesida and Arakale Roads for the purposes of this study show the dominance of residential and commercial

land uses. The land uses for the different years were calculated using the calculated geometry in the ArcGIS 9.2 environment.

The results of the area occupied, and percentage coverage of each land use type is shown in Table 2.

Table 2: Landuse change for CBD from 1993 to 2023

Land use Type	1993		2002		2012		2023	
	(Km <sup>2</sup> )	%	(Km <sup>2</sup> )	%	(Km <sup>2</sup> )	%	(Km <sup>2</sup> )	%
Residential	0.67	75.3	0.44	49.4	0.17	19.1	0.04	4.5
Commercial	0.16	18.0	0.41	46.1	0.70	78.7	0.74	83.2
Vegetation	0.06	6.7	0.04	4.5	0.02	2.3	0.11	12.4

From Table 2 residential land uses cover a land area of 0.67 km<sup>2</sup> in 1993 accounting for 75.3% in land use. In 2002, the land area covered by residential land has reduced to 0.44 km<sup>2</sup> accounting for 49.4% of the total land use. Furthermore, in 2012, the land area covered by

residential land use was 0.17 km<sup>2</sup> accounting for 19.1% of the land uses while the land area for residential land uses further reduced to 0.04 km<sup>2</sup> in 2023 accounting for 4.5% of the total land use. This therefore shows a high rate of conversion and land use changes as a



result of the reduction in the area used for residential land uses in the central business districts.

For commercial land uses on the other hand, the land area covered in 1993 was 0.16 km<sup>2</sup> accounting for 18% of the land uses. In 2002, the land area covered for commercial land uses increased to 0.41 km<sup>2</sup> thereby accounting for 46.1% of the land use. Furthermore in 2012 and 2023, the area covered by commercial land uses increased to 0.70 km<sup>2</sup> (78.7%) and 0.74 km<sup>2</sup> (83.2%) of the land use.

Table 2 shows a major change of land use from residential to commercial land uses at Akure City core. This situation is

particularly true for Oba-Adesida Road and Arakale Roads showing a large number of land use changes and commercial land uses in the study area.

Figure 3 showed that in 1993 residential land use dominated Akure City core up until 2002 when it equaled commercial land uses. However, increased land use changes led to a decline in residential land uses and an upward increase in commercial land use up till 2023. Significantly, between 2012 and 2023 commercial land uses had a relatively steady increase compared to the preceding decade.

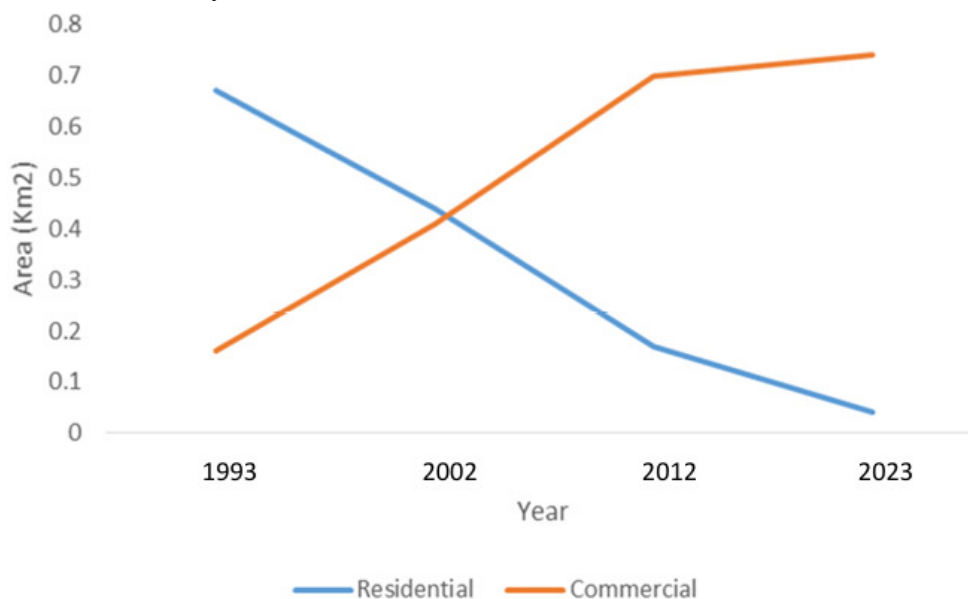


Fig. 3: Graph of residential and commercial Land use at the city core from 1993 to 2023

#### ***Pattern of Land Use Changes in Akure City Core***

The respondents' opinion on the pattern of land use changes was also examined during the course of the research. The various opinions of Estate Surveying and Valuation firms as well as the occupants

along Oba-Adesida and Arakale Roads on the pattern of land use changes were examined and presented in Table 10. Kruskal-Wallis H test was also further conducted to ascertain the difference in the opinion of the respondents.

Table 3: Pattern of Land Use Changes in Akure City core

Pattern of Land Use Changes	Practicing Estate Surveying and Valuation Firms			Occupants Along Oba-Adesida road			Occupants along Arakale Road			Kruskal-Wallis H test		
	Mean	Std. Dev	Rank	Mean	Std. Dev	Rank	Mean	Std. Dev	Rank	Chi Square	Df	Asymp. sig
Alteration & Internal modification of properties.	4.1364	1.12527	2 <sup>nd</sup>	4.4066	.84298	2 <sup>nd</sup>	4.4615	.78732	2 <sup>nd</sup>	1.324	2	.516
Complete renovation	2.9091	.92113	4 <sup>th</sup>	2.6593	.89715	5 <sup>th</sup>	2.7212	.88632	5 <sup>th</sup>	1.014	2	.602
Vertical Increase in Floors	2.2273	1.19251	5 <sup>th</sup>	3.5714	.94449	4 <sup>th</sup>	3.5769	.88890	4 <sup>th</sup>	22.674	2	.000
Change of use & function	4.0000	1.06904	3 <sup>rd</sup>	4.5055	.50274	1 <sup>st</sup>	4.5000	.50242	1 <sup>st</sup>	4.073	2	.130
Pull down & Redevelopment	4.1818	1.13961	1 <sup>st</sup>	4.0879	.72493	4 <sup>th</sup>	4.1442	.72965	3 <sup>rd</sup>	1.881	2	.390

As revealed from the research, the Practicing Estate Surveying and Valuation firms opined to the pattern of land use changes to involve pull down and redevelopment (4.1818); alteration and internal modification of properties (4.1364); change of use and function (4.000) complete renovation (2.9091) which have been ranked 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> respectively as the major patterns of land use changes at the City core.

From the perspectives of the occupants along Oba-Adesida Road and Arakale Roads, both respondents both opined to the pattern of land use changes to include change of use and function, alteration and internal modification of properties, pull down and redevelopment and vertical increase in the number of floors which have been ranked 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> respectively.

The results in Table 3 further present an asymptotic significance of the pattern of land use changes using the different respondents (Estate Surveying and Valuation firms, occupants along Oba-Adesida Road and Arakale Roads) as the grouping variables. Five (5) different patterns of land use changes were considered based on the respondents' opinions. The research revealed that there is no statistical significant difference in the response of the respondents across the three (3) strata of respondents with a significant level of higher than 0.05. Alteration and Internal modifications of properties ( $p = .516$ ); complete renovation ( $p = .602$ ); change of use and function ( $p = .130$ ) and pull down and redevelopment ( $p = .390$ ) shows significant values of  $> 0.05$ . This implies that there is no statistically significant difference in the response of the respondents based on the pattern of land use changes.

### **Conclusion and Recommendation**

The study examined Trend in Land Use Change in Akure City Core Between 1993-2023 with a view to maximizing urban land use potentials. Land use change and conversion occur within the city core as revealed in the course of the research. The existing land use patterns in Arakale and Oba-Adesida, Akure have changed geometrically from 1993 till 2023 from their original usage. The analysis showed that in 1993 residential land use dominated Akure City core up until 2002. Significantly, between 2002 and 2023 commercial land uses had a relatively steady increase compared to the decades before. The dominant land use change is commercial land use which has penetrated and invaded the traditional setting of the city core. It was further revealed that most of the land use changes from residential to commercial land uses are driven by proximity to market; proximity to road; nearness to place of residence; government zoning policy and condition of the commercial property.

It was recommended that the state government should make zoning law applicable and practicable, also create new towns to reduce the level of migration of commercial activities to the city core while Planning agency of the State should also regulate the pattern of land use changes within the Core area of the town.

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