Original Research Article

SPATIAL GROWTH OF CALABAR METROPOLIS: DETERMINANTS AND EFFECTS

Abstract

The physical development in Calabar metropolis has been restricted by the rivers surrounding it, which has further led to the development of unplanned settlement in haphazard arrangement within the metropolis, which therefore, requires proper and effective assessment. This study focused on examining the extent of growth of the built-up land area of Calabar, determinants and effects of the spatial growth of Calabar metropolis from 1987 to 2018. Data for the study was derived using questionnaire and in-depth interview and Relative Importance Index (RII) was used to analyze and rank the perception of respondents. Findings from both questionnaire survey and in-depth interview revealed that agricultural land-use was the major land use as at the year 1987. While built-up was identified as the major land use in 2018 implying a drastic change in the land-use change in the metropolis over the years. Finally, findings of the RII on the determinants and effects of the spatial growth of Calabar metropolis revealed that increase in population is the major determinant of the growth of the built-up area of the metropolis while increase in the cost of land within the metropolis is the most influential factor as a result of the spatial growth of the metropolis. The study recommended that improved rural programs should be embarked to reduce rural-urban migration and development of low-cost housing, accessible housing loans and grants should make available for the entire residence of Calabar irrespective of any bias which will curb the high cost of land and house rent within the metropolis among others.

Keywords: Urban growth, Urbanization, Perception, Relative Importance Index,

Introduction

Urban growth rates have been on the increase over the years. This growth is defined as the rate at which the population of an urban area increases. The pace of urban population growth depends on the natural increase of the urban population and the population gained by urban areas through both net rural-urban migration and the reclassification of rural settlements into cities and towns (UNICEF, 2012). The increasing annual world's urban population is expected to peak at almost 80 million during this present decade (Gordon and David, 2014). In the same vein, UNFPA, (2007) projected additional increase of 944 million urban dwellers in Africa and 1,449 million in Asia from the year 2010 to 2050. This is equivalent to about two third of the urban population in 2010, and is about the same figure as the overall increase in population predicted for the 2010 to 2050 period. Similarly, UN (2014) stated that the percentage of urban population increase in 1950 was 30%, it increased to 54 % in 2014 and it is estimated to be 66 % by 2050.

Rapid urban development usually happens at the expense of prime agricultural land, with the destruction of natural landscape and public open spaces, which has an increasing impact on the global environmental change (Liu, 2009). The level of urban growth increases because people move from rural areas to urban areas in large number. It becomes more so when a country is in the process of development including industrialization and other non-agricultural activities (Davis, 1965). This rapid growth of urban population not only changes the internal structure of the city itself, but also it exerts tremendous pressure upon its fringe areas. As a result of this, remarkable changes are observed in the land use pattern and other socio-economic aspects in the fringe areas (Begum, 2010).

Calabar Metropolis is not an exception to the Urban Growth witnessed in urban areas across the globe. For instance, the population of Calabar metropolis as at 1991 was 328,878, it was projected to be 555,696 for the year 2018 (Erhabor *et al.*, 2019). This indicated a 59 % increase in the population of the metropolis for a period of 31 years. Thus, implying a growth in the population of the area. The speedy urban growth has led to alteration of several land uses, which is as a result of the construction of new residential and industrial layouts, recreation and amusement parks, etc. (Hansen *et al*. 2005; Oka, 2009; Offiong and Eteng, 2014). However, the restriction placed on the physical development in Calabar metropolis by the Calabar river, the Kwa river and the wetlands of the Cross-river estuary towards the west, east and south of the city

according to Effiong (2011) has resulted in a serious competition for available land within the city.

The continuous alteration in land use in Calabar Metropolis as a result of urban growth has further led to the development of unplanned settlement along drainage lines, flood-prone areas, green areas as well as gully erosion devastated areas like Awatim, Edim otop, and Akaifa districts. This unpleasant pattern of development in some parts of the metropolis has left the city with attendant environmental consequences that sterns from extensive urban poverty, recurrent flooding, slum growth, extensive alteration of wetland ecosystem and forest ecosystem. These environmental challenges according to Sule (2009) have detrimental effects on the aesthetics of the built environment, human health, the general standard of living and are fundamental precursors to slum prevalence in Calabar metropolis. Absence of accurate information on the determinants and effects of the urban growth will only compound the current challenges and future development plan for the Metropolis. Remote sensing and Geographic Information Systems (GIS) have proven to be very significant in urban studies as it is capable of monitoring spatial changes in the general environment (Erhabor *et al.*, 2019). However, several studies have been carried out on urban growth in Calabar metropolis, but there is a dearth of studies on the perceptions of the residents on the determinants and effects of the growth of Calabar using the Relative Importance Index (RII).

In essence, a timely investigation of the determinants and effects of the urban growth is needed. Therefore, this study focused on examining the extent of the built-up land use from 1987 to 2018, the perception of respondents on the major land use in Calabar and its determinants in as at 1987 and 2018, perception of respondents on the changes in land use, RII of the determinants of the spatial growth of Calabar metropolis and RII of the effects of the spatial growth of Calabar metropolis.

MATERIALS AND METHODS

Study Area

Calabar Metropolis lies between latitudes $4^{\circ}54' 00''$ N to $5^{\circ}04' 00''$ N and longitudes $8^{\circ}18' 00''$ E to $8^{\circ}24' 00''$ E and it is bounded by Calabar River, to west, Kwa River to the East, Odukpani L.G.A to Northern flank and the estuaries of the Atlantic Ocean in the south. The metropolis covers a

land area of 427.05km². Calabar is the capital city of Cross River State, southern Nigeria. It comprises of Calabar Municipality and Calabar South Local Government Areas (LGAs). There are 22 wards in both LGAs, 10 in the later and 12 in the former, numbers are being used as the name the wards in the study area.

Calabar was the capital of the southern protectorate of Nigeria from 1886 to 1904 and one of the earliest seats of local government administration in the then Eastern Region up to 1952. The main dwellers of the area are the Efiks, the Efuts, and the Quas whose major widely spoken language is Efik and Ejagham. It is located in the southern senatorial district of the State. Calabar Metropolis had a population of 328878 dated way back to 1991. This figure increased to 375,196 in 2006 (NPC, 2006) with Municipality having a figure of 183,681 and Calabar South 191,515. However, the population of the study area was projected with a 2.54 % growth rate for the year 2018 and is given as 555,695 as shown in Table 1. This population is characterized by people from numerous ethnic groups of different states in Nigeria and other countries alike. Given the population of the area in 1991, the city had a population density of 2399 while in 2006; the density was 2737 persons per km^2 (Okon & Njoku, 2017).

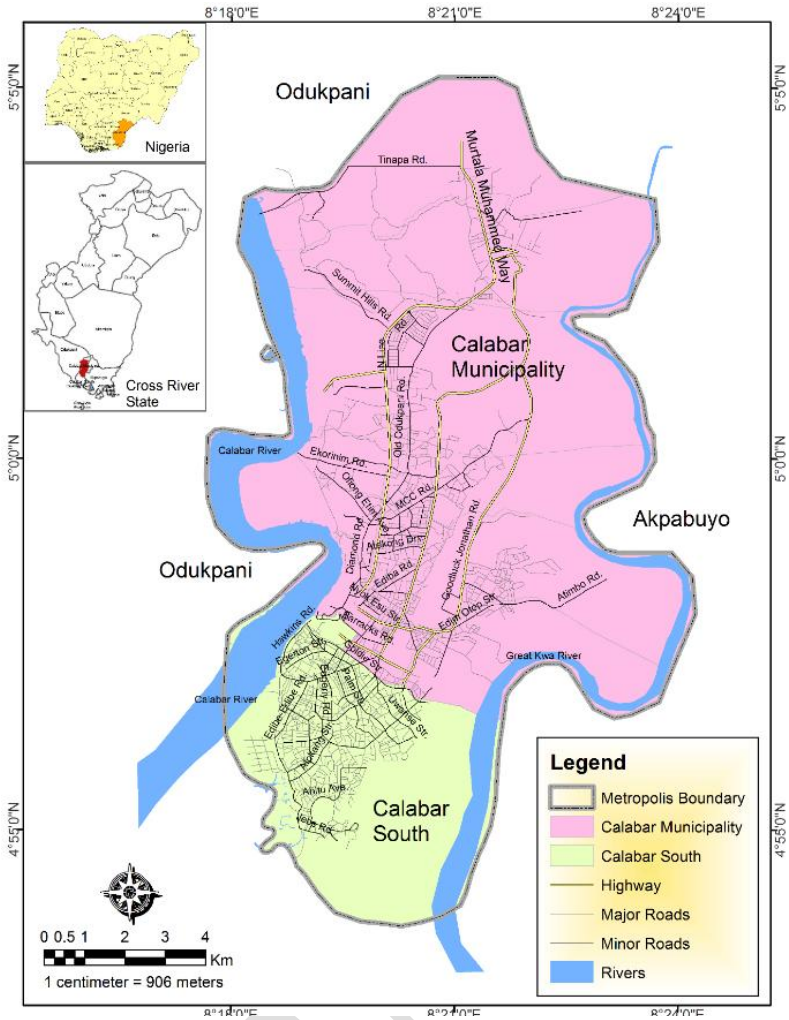

Figure 1: Calabar Metropolis.
Source: Office of the Surveyor General of Cross River State (2017)

Data Types and Sources

The administrative boundary of the study area was obtained from the Office of the Surveyor General of Cross River State while the population of the area was obtained from the National Population Commission. Data on determinants of urban expansion in the area and effects of urban expansion in the metropolis were gotten through the administration of questionnaires and through interviews. The Smith (2000) formula for finite population was employed to statistically determine 384 as the minimum sample size for the study. Therefore, 384 copies of questionnaire were prepared and distributed in the study to source for data on the socio-demographics of respondents, data on the major determinant of urban growth and the effects of urban growth in

the metropolis. Landsat 5 TM of 1987 and 1997, Landsat 7 ETM+ of 2008 and Landsat 8 OLI of 2018 with spatial resolutions of 30 meters were obtained from United States Geological Survey (USGS) Land-Look platform. The images were used to determine the extent of urban expansion through land use/ landcover change detection analysis.

Data Processing Techniques

Image Pre-processing

The satellite imageries acquired were already Otho-rectified, thus there was no need for georeferencing. The area study was subset from each large scene of the satellite imagery by using the extract/clip tools in ArcGIS 10.4 software.

Image Classification

Supervised classification technique was performed using the maximum likelihood classification (MLC) algorithm in classifying the imageries into various classes. Firstly, to perform MLC, a combination of ground truthing data (ground control point) with hand held GPS (Garmin 60CSx handheld GPS receiver) as well as field identification and observation of features were carried out. This was to enable the generation of training classes/ sites in line with the actual land use/land cover themes existing within the study area. The Anderson *et al* (1976) classification scheme was adopted for this study, modified to suit the present land use classes exiting in the study area. The output of the classified raster was vectorized in order to measure the extents. The area coverage of each LULC class that was vectorized were tabulated in km² for each of the years under review.

Data Collection and Analysis

Purposive sampling technique was used to select respondents that were sampled in the study area and the questionnaires were administered purposively to the respondents of interest who have lived and are familiar with the study area for a minimum of 30 years in each ward respectively.

In-depth interviews were also conducted to obtain substantial information the major determinant and effects of urban growth in the study. A total of 7 stakeholders were interviewed comprised of a staff of 3 government ministries saddled with the responsibility of physical planning in the State (Ministry of Lands and Town Planning, Office of the Surveyor General of Cross River State and Cross River State Geographic Information Agency) and 4 major clan heads in the metropolis which are represented as (A, B, C, D, E, F, G). This is in line with the recommendation of Creswell (1998) who recommended that a minimum of 5 and maximum of 25 persons is sufficient to achieve saturation, a point at which data collection process no longer offer any new or relevant data (Charmaz, 2006). The in-depth interview gave more insight on

the determinant and effect of the growth on Calabar metropolis as the informant are people who have lived and deals with land related matters in the study area.

The RII analysis allows identifying most of the important criteria based on participants' or respondents' perception and it is also an appropriate tool to prioritize indicators rated on Likert scale. The RII was used to analyzed and ranked the perception of respondents on the major determinant and effects of the spatial growth of Calabar metropolis and the results were presented in tables and graphs. The RII formula is given thus:

RII=Sum of weights (W_1 + W_2 +W_3 +W_4 +W_5) / A x N

Where:

W = the weighting as assigned by each respondent on a scale of one to five with one implying the least and five the highest.

A = the highest weight.

N= is the total number of the sample.

Results and Discussion

Extent of built-up land use in Calabar metropolis from 1987-2018

An assessment was made of the expansion of the territory built in the metropolis of Calabar from 1987 to 2018, and the results are presented in Table 1 and Fig. 2-5 The analysis showed that the expanse of the built-up land use in 1987 was 32.91 km², which is 12.83% of the total metropolitan area. In 1997, the built-up land area was 47.34 km², accounting for 18.46% of the total land area of the metropolis. Also, in 2008 the built-up area was 58.68 km² (22.87%), and in 2018 the built-up land use slightly increased to 59.55 km², which is 23.22% of the total area of the metropolis. It can be concluded that from 1987 to 1997 there was sharp increase in built-up land use of Calabar metropolis.

Also, analysis showed that the magnitude of growth of the built-up land use in Calabar metropolis between 1987 and 1997 increased by 14.43km² (43.85 %) at the rate of 1.44 km²/yr. (4.38 %/yr.), while the magnitude increased by 11.34km² (23.95 %) at the rate of 1.03km²/yr. (2.18 %/yr.) between the year 1997 and 2008. However, the magnitude of built-up land use in the metropolis increased by 0.87km² (1.48 %) at the rate of 0.1km²/yr. (0.17 %/yr.) between 2008

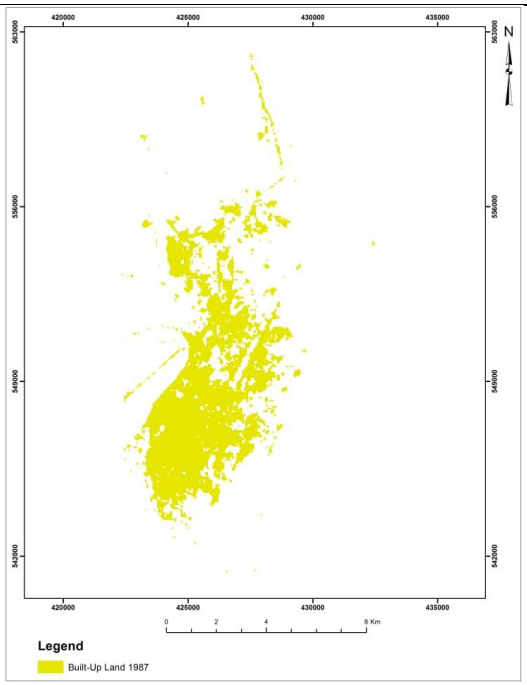

Figure 2: Extent of urban growth in Calabar (1987)

Source: Author's Analysis 2019

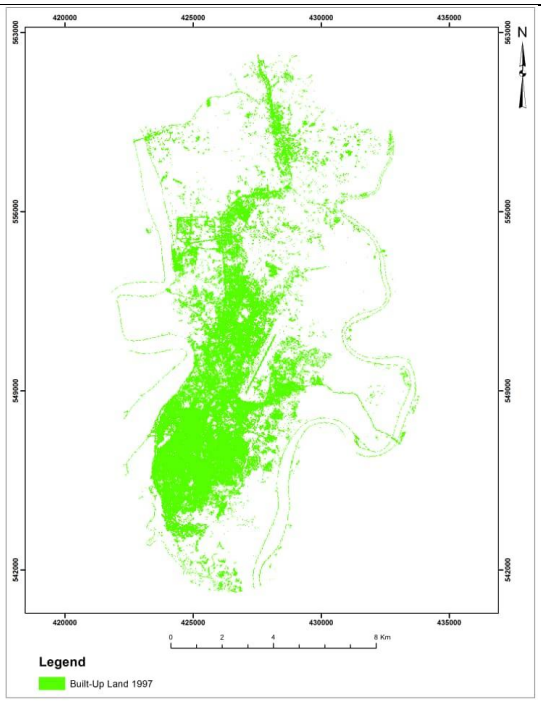

Figure 3: Extent of urban growth in Calabar (1997)

Source: Author's Analysis 2019

and 2018. From the foregoing it can be deduced that the the highest spatial growth was experienced between the year 1987 and 1997. In conclusion, the analysis revealed that within the year 1987 and 2018 (31 years), the built-up land area increased by 26.64km² (80.98%) at the rate of 0.86km² (2.61%) annually. This expansion of the built-up area is attributed to the economic and rapid infrastructural developmental processes experienced as a result of Calabar being the capital of Cross River State (Erhabor *et al.*, 2019).

Table 1: Extent and rate of the built-up land area in Calabar metropolis from 1987 to 2018

Urban Built-up				Magnitude of Growth		Rate of Growth	
Period	Year	km²	%	km²	%	km²/Year	%/Year
1987-1997	1987	32.91	12.83	14.43	43.85	1.44	4.38
10 years	1997	47.34					
1997-2008	1997	47.34	18.46	11.34	23.95	1.03	2.18
11 years	2008	58.68					
2008-2018	2008	58.68	22.87	0.87	1.48	0.1	0.17
10 years	2018	59.55					
1987-2018	1987	32.91	23.22	26.64	80.95	0.86	2.61
31 years	2018	59.55	77.38				

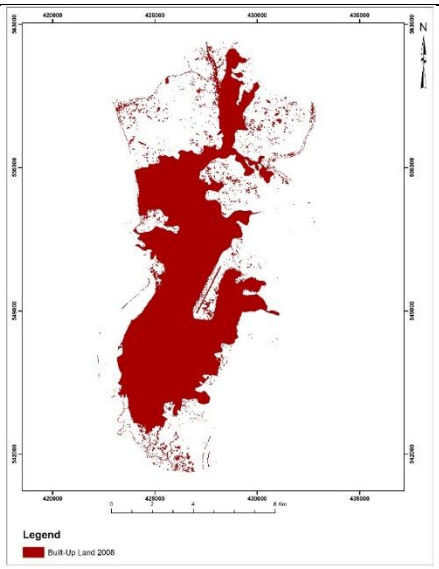

Figure 4: Extent of urban growth in Calabar (2008)

Source: Author's Analysis 2019

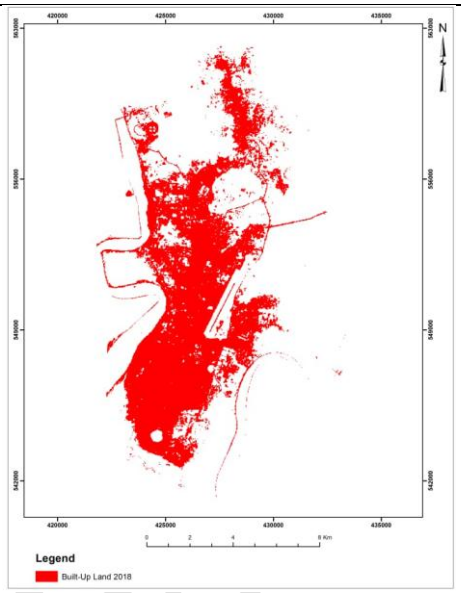

Figure 5: Extent of urban growth in Calabar (2018)

Source: Author's Analysis 2019

A- Perception of Respondents on the Major Land Use and its Determinant in Calabar as at 1987 and 2018

The findings from the assessment of the perception of respondents on the land use scenario as at the year 1987 in Calabar metropolis revealed that agricultural land use was the major land use type during the period. This might be attributed to the fact that agriculture was a major anthropogenic activity at the time. This corroborates with the findings of Chete et al., (2014) that agriculture used to be an integral part of the nation's economy, providing food and employment for the populace, raw material for the nascent industrial sector among others. On the other hand, findings revealed that built-up land use was the major land use type in the year 2018. This is due to an increase in population as a result of Government presence in the metropolis. This is in agreement with the findings of Atu *et al.*, (2012) who in their study revealed that built-up area has busted outward in an explosion of growth that consumed former agricultural land at a break-neck pace, and thousands of hectares of agricultural land are covered by concrete and asphalt as new roads are created and existing ones are extended.

This result also conforms with the responses of in-depth interviews conducted in the study area. All the interviewees (A, B, C, D, E, F, G) agreed that agricultural land use used to be the major land use in the metropolis as at the year 1987. Interviewee A said that:

"Currently, the major land use in Calabar metropolis is built up, which comprises residential, commercial, religious, administrative, Education and Medical built-up. Take for instance Nyanhasang area, Edim otop, satellite town that was completely farmland and has changed to built-up because of the establishment of university of Calabar and teaching hospital and consequently population increase"

Similarly, interviewee B opined that:

"*The major land use were forest and farmland with sparse formation of residential settlement. For instance, before the time of governor Donald Duke the new secretariat was a major forest."*

Likewise, interviewee C opined that:

"Before the civil war, the old Calabar was the area that had a few built-up area. But during the General Ibrahim Babangida era which extended to 1987, Akim which was a farm estate change speedily from farm land to residential area. So, the predominant land use as at 1987 in Calabar metropolis was farm land"

B- Perception of the Changes in Land Use

The result showed that a vast majority of the respondents which represent 62.5% stated that the lan duse has change from agricultural to residential. This might be as a result of urbanization and several governmental projects and development like establishment of tertiary institutions, military barracks and housing estates among others.

Table 2: present respondents' perception on how the land use has change from one type to another.

If yes how has the land use change been	Frequency	Percentage (%)
Agricultural to Residential	240	62.5
Residential to Industrial	37	9.6
Urban Green Field to Residential	63	16.4
Agricultural to Industrial	44	11.5
Total	384	100

Source: Author's Analysis, 2019

C- Perception on the Pace of the Land use Change

As seen in Table 3, 52.9% of the respondents affirmed that the process in which one land use was converted to another land use type was gradual while 47.1% of the respondent stated that the process was rapid. This might be due to the fact that development is a gradual process as it does not happen overnight. This agrees with the findings of Ade and Afolabi (2013) in Nigeria that all cities apart from Abuja are organic in their origin and developed gradually over a long period of time as they build on existing precolonial urban centers.

Table 3: Pace of the land use has changed

What was the process of the land use change	Frequency	Percentage (%)
Gradual	203	52.9
Rapid	181	47.1
Total	384	100

Source: Author's Analysis, 2019

D- Spatial Growth of Built-up in the Past Decade in Calabar Metropolis

As depicted in Table 3, the study revealed that all the respondents acknowledged that the built-up areas have expanded in the past decade. This has been attributed to increase in population in the metropolis due to government presence. This is in conformity with the findings of Omojola and Jegede (2013) who acknowledged that the most remarkable feature of the urban growth is the increasing human population.

E- Perception of Growth Rate of the Built-up Area

The figure below shows the growth rate of built-up area in Calabar metropolis and it revealed that 54.4% of the respondents stated that the rate in which the build-up area has grown was very high, 31% stated high, 9.4% stated normal, 2.9% sated low while 2.3% very low rate.

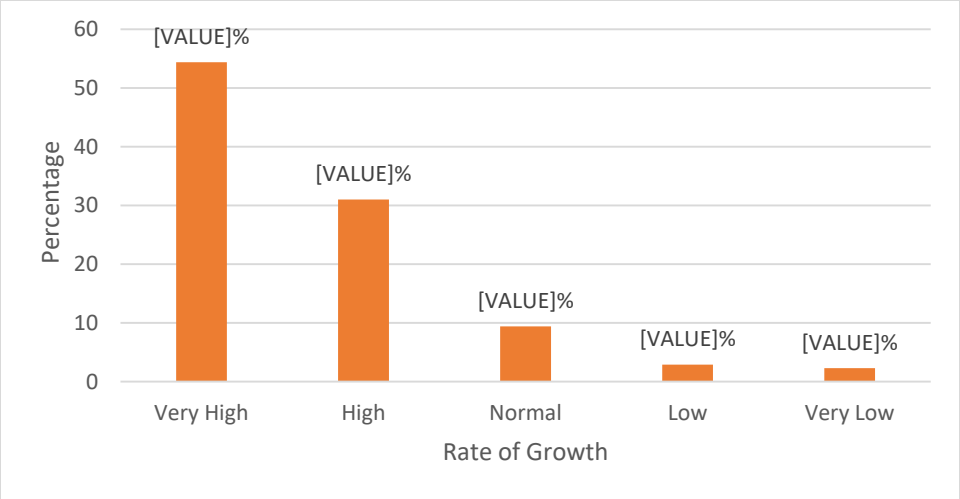

Figure 6: Perception of Growth Rate of the Built-up Area
Source: Author's Analysis, (2019)

It was observed that majority of the respondents said that the rate of growth of the built-up area in Calabar metropolis was of a very high degree. This has been attributed to increase in population in the metropolis due to government presence. This is in conformity with the findings of Effiong (2011) who affirms that rapidly increase in human population and decreasing agricultural activities have brought about extensive land-use alterations throughout the world. This result conforms with an in-depth interview conducted in the study area. All the interviewees (interviewee A, B, C, D, E, F, G) agreed that built up land has expanded in the past decade.

Relative Important Index (RII) of the Determinant of the Spatial Growth of Calabar Metropolis

The ranking of the determinant of the spatial growth of Calabar metropolis was computed and shown in Table 4. It was observed that the 384 of the respondents stated that the spatial growth of Calabar metropolis is being influenced by some of the factors in Table 4. With regards to the factors responsible for the growth of Calabar metropolis. Creation of satellite towns had the highest ranking (1^{st}) which suggests that it is the most significant factor that is influencing the spatial growth of the metropolis, availability of job and topography had a ranking of 7^{th} and both tourism and access to health facilities was ranked 2^{nd} and 3^{rd} respectively, However, increase in

the number of industries was ranked 4th while presence of social amenities was ranked 6th. This conforms with the findings of the in-depth interview conducted which suggested that creation of satellite towns and industrialization as well as good social amenities which on the other hand led to increase in population with the metropolis are the major determinant of Calabar metropolis.

Table 4: presents the results of the *RII* on the determinant of the spatial Growth of Calabar Metropolis

	Rating (W)							
Factors	1	2	3	4	5	∑W*N	*RII*	RANK
Presence of social Amenities	3	4	8	109	260	1771	0.922	6th
Availability of Job	9	0	41	68	266	1734	0.903	7th
Topography	0	6	17	135	226	1734	0.903	7th
Presence of Tertiary institution	0	0	15	81	288	1809	0.942	4th
Tourism	0	0	0	69	315	1851	0.964	2nd
Access to Health facility	0	0	9	53	322	1849	0.963	3rd
Availability of Industries	0	10	18	59	297	1795	0.934	5th
Creation of satellite town	0	0	9	25	350	1877	0.977	1st

Source: Author's Analysis, 2019

However, this result from the interview validates the LULC analysis which showed that built-up has taken up a substantial part of other land use in the study area due to an increase in population. Because landscape transformation in urban environment throughout space and time are mainly dominated by anthropogenic activities and are greatly influenced by the spatial expansion of built-up land. Andrea and Paolo (2011) stated that cities with higher sectorial diversity, younger population, higher initial share of foreign residents grow faster. It has been also found that higher initial unemployment rates are strongly associated with slower population growth and that spatial effects play an important role as well. Ade and Afolabi (2013) also identified population dynamics as underlying drivers of development and environment changes in any city.

Relative Importance Index of the Effects of the Spatial Growth of Calabar Metropolis

The data in Table 5. is the output of the ranking of the relative important index (RII) of the effect of the spatial growth of Calabar metropolis. It is worthy of note that out of the 384 respondents 268 of the respondents which make up 70% of the study population stated that the spatial growth

of Calabar metropolis poses some effects on the metropolis. Increase in the cost of land within the metropolis had the highest mean ranking of 1st which suggests that it is the most significant factor that on the effect of the growth of the metropolis. Conversion of farm lands to residential within and at the fringes of the metropolis was ranked 10th, high rate of crime and conversion of urban fringes to urban area were ranked 5th while forest depletion at the fringe of the metropolis had a ranking of 7th, environmental pollution was ranked 8th, pressure on road was ranked 9th and poor state of housing had a ranking of 6th. Interestingly, increase in the cost rent was ranked 3rd and pressure on land within the metropolis has the second highest ranking of 2nd and availability of skilled job had a ranking of 4th while erosion and traffic congestion within the metropolis had a ranking of 11th and 12th respectively. The figures revealed that the growth of Calabar metropolis has high influence on all of the factors.

Table 5: presents the results of the *RII* of the effects of the Spatial growth of Calabar metropolis

	Rating (W)							
Factors	1	2	3	4	5	∑W*N	*RII*	RANK
Availability of skilled jobs	2	4	6	105	250	1702	0.925	4th
Conversion of urban Fringes to urban area	2	2	30	105	229	1660	0.902	5th
Conversion of Farm lands residential within and fringes of the metropolis	0	2	25	220	121	1564	0.850	10th
Forest depletion at the fringe of the metropolis	0	17	21	114	216	1633	0.887	7th
Environmental pollution	1	13	26	113	215	1632	0.886	8th
High rate of crime	0	5	23	118	222	1661	0.902	5th
Pressure on road	2	5	33	132	196	1619	0.879	9th
Poor state of housing	0	3	38	119	208	1636	0.889	6th
Pressure on land within the metropolis	0	0	0	115	353	1725	0.937	2nd
Increase in the cost of land within the metropolis	0	0	3	107	258	1727	0.938	1st
Increase in the cost of house rent	0	0	31	64	274	1715	0.932	3rd

Erosion	9	25	58	130	147	1488	0.808	11th
Traffic congestion within the metropolis	15	7	121	129	96	1388	0.754	12th

Source: Author's Analysis, 2019

The result agrees with the findings of Joseph *et al.*, (2014) which revealed that the urban infrastructures such as roads/streets, electricity, water supply system and waste management system are depreciating and this has compounded the way the cities are sprawling far beyond the range for which the facilities were planned and projected. It is therefore obvious that urban growth has negative impact on the infrastructure and sustainability of cities. Improper land use in form of improper planning, high-density settlements, illegal conversion of open spaces among others are common phenomenal that adversely affect the city's architecture (Olubi, (2020). Nigerian cities are known with several challenges which militates against urban growth such challenges include deterioration of cities into slums, pollution, congestion, unsanitary condition, non-functioning infrastructures, littering of cities with illegal, informal structures among others. (Aribigbola, 2008).

Also, social perception of people within a city is of a great importance in ensuring proper planning and development of urban area as seen in the study of Sergio (2015) who stated that public space cannot be interpreted from an aesthetic point of view until it has previously been interpreted from a social point of view. Only when society identifies or defines the role of public space, then take ownership of it and begins to worry about its aesthetic quality. But the opposite is also true: the aesthetic quality of public space encourages people to use and live it, therefore improving their social perception.

Conclusion and Recommendation

Findings of this study revealed that there has been a steady and sluggish increase in the extent of the built-up area of the metropolis, with the period between 1987 and 1997 having the highest growth extent within the period under study which was the first decade Calabar became the capital of the new Cross River State. Similarly responds from the in-depth interview showed that the predominant land use in Calabar as 1987 was agricultural land use which has been taken over by built-up land use as seen in year 2018. Result further, revealed that increase in population was seen to be the major determinant of the spatial growth of Calabar metropolis which is as a result of immigration of people into the city and high birth rate in the metropolis. While increase in the cost of land and high cost of rent respectively within the metropolis has been highly influenced by the spatial growth of Calabar metropolis. The study recommends that the Cross-River State ministry of Lands and Town planning should adopt and enforce integrated spatial techniques in monitoring and controlling urban growth as it has the capacity to integrate all urban features such as land cover, land uses and urban infrastructures, also Improved rural programs should be embarked by the Cross-River state government to reduce rural-urban migration as well as intensified awareness on the importance of birth control and development of low-cost housing, accessible housing loans and grant should made available for the entire residence of Calabar irrespective of any bias which will curb the high cost of land and house rent within the metropolis.

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