Assessment of urban sprawl in Benin metropolis, Nigeria

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***Abstract*:- Urban sprawl is a scattered type of urban growth that alters the layout and shape of urban settlements. It is one of the consequences of extraordinary rapid urbanisation and uncontrolled urban growth that has created significant perils for city governance and natural resource management, particularly in the peri-urban areas. This article assesses the socio-demographic characteristics of peri-urban residents in the study area; investigates the spatio-physical pattern of Benin City, and examines the Compact City Concept (3C) as a mechanism to manage urban sprawl to achieve integrated physical development and a sustainable built environment in Benin Metropolis. A structured questionnaire was developed and administered to selected heads of households in the two hundred and one buildings examined on the outskirts of Benin City using a purposive random sampling technique. The collected data were processed using the Statistical Package for Social Sciences (SPSS 25) and analysed with Spearman Rho and point-biserial correlation tests, and regression analysis presented in tables. The secondary data were relevant current literature used to supplement the primary data. The findings indicated that the socio-demographic characteristics of the people, insufficient access to the central business district, and deficient transport infrastructure instigated urban sprawl in Benin metropolis. This paper recommends the application of compact city mechanisms like the flexible architectural design for multi-habited buildings, and efficient mass transportation intervention. Land title registration, building design and planning systems, and the use of contemporary remote sensing technologies such as Google Earth, ArcGIS, and Landsat to monitor physical growth were also advocated.**

Keywords: **Built environment, Compact City Concept, Sustainability, Urbanisation, Urban sprawl**

I. INTRODUCTION

According to Gbadegesin, Oladokun, and Ayorinde (2011), every city has a distinct history defined by its growth and expansion. Cities attract people globally because they are concentrated areas with a high population density; they occupy about 2% of the earth's land but house more than half of the world's population (Terradas, 2002; Gomes & Salvador, 2006; Olayiwola & Igbavboa, 2014). Cities have been the beating heart and lifeblood of numerous civilisations for ages, serving as economic, political, and cultural hubs (Spates & Macionis, 1987). This aligns with Odeyale's (2010) observation that cities serve as a focal point for commercial activity. This is why Ayedun, Durodola and Akinjare (2011) referred to the city as a distributional mechanism because it seems to reflect human beings and their institutions interacting in a densely settled finite space to produce and distribute economic resources, services, and other values. This indicates that transportation technologies shape metropolitan forms.

A city is not just a composition of man-made structures rather a collection of interconnected habits, conventions, and lifestyles (Sepe, 2006). This argues that a city's identity is determined by people's activities and behavioural patterns, as well as government policies and programs. Complexity, simultaneity, and instability typify contemporary cities occasioning transitory conditions and permanent transformation. Opoko and Oluwatayo (2014) emphasised, however, that cities are expected to provide work, shelter, stability, prosperity, security, social inclusion, and equitable access to services as the centres of civilisations and various cultures. Thus, the inability of a city to provide these basic human requirements identified above by Opoko and Oluwatayo (2014) portrays it as a failure. That is the city centre can no longer sustain a large number of residential dwellings, thus, resulting in distributed growth on the urban periphery dubbed urban sprawl.

Without the careful application of urban design principles and land use planning techniques, the backwash and trickledown effects of overpopulation and increasing demand for land use in metropolitan areas may have resulted in low-density ribbon, leapfrog, or isolated physical development along many urban fringes in Nigeria, and Benin City in particular. Scarce planning control, insufficient access to public facilities, deficient transportation and network system, haphazard development, as well as segregation and exclusion from city activities are some of the usual issues encountered in many urban suburbs where sprawl has manifested.

Among deliberations over precise delimitation of urban sprawl, Queslati, Alvanides, and Garrod (2015) posited that a wide-ranging compromise appears to be evolving which describes urban sprawl as a phenomenon characterised by an unplanned and uneven pattern of urban development caused by a variety of processes that result in inefficient land resource utilisation. Consequently, according to Wapwera (2012), urban sprawl is an unplanned extension of cities induced by deficient planning control over land subdivision, characterised by low-density expansion on adjacent

agricultural areas along transportation corridors connecting cities. This is to say that urban sprawl is instigated by the spread effect resulting from scarce accommodation of physical development at the downtown thus pushing development to the city fringe. The foregoing characteristics describe Benin metropolis, particularly along and around the interchanges of the transit routes at Sapele, Abraka, Agbor, Ekpoma and Oluku bye-pass road axes connecting other parts of Nigeria.

Although numerous strategies such as transit regulation, the establishment of urban borders, public involvement in infrastructure costs, improvement of the socio-demographic situation for low-income households, control of expansion and conservation of lands (Habibi & Asadi, 2011) have been advocated. Others like curtailing urban land usage, increasing urban attractiveness and housing capacity, assisting agriculture-based buildings, and integrating and collaborating across jurisdictional borders (Fertner, 2016) have also been canvassed. Notwithstanding, the use of remote and social sensing, and demographic data to evaluate urban sprawl (Shao et al., 2021), and flexible access to service quality of urban public infrastructure are also among the proposals to assuage the proliferation and spread effects of urban sprawl and protect metropolitan regions.

Regardless of these prior proposals by scholars (Habibi & Asadi, 2011; Fertner, 2016; Shao et al., 2021), overwhelming human and environmental difficulties yet abound. This is because the compact city concept has not yet received in-depth studies, nor adequately canvassed in Nigeria, particularly in Benin metropolitan as a physical development control mechanism to ease urban sprawl. Against this backdrop, this article assesses the socio-demographic characteristics of peri-urban residents in the study area; investigates the spatio-physical pattern of Benin City; and examines the Compact City Concept (3C) as a mechanism to manage urban sprawl to achieve an integrated physical development and a sustainable built environment in Benin Metropolis, Nigeria.

II. LITERATURE PERSPECTIVE

2.1 The Concept of a City

Bertaud (2014) described a city as an inhabited centre location for a variety of activities such as religious, military, political, economic, educational, and cultural activities that take place within its bounds and have an effect on neighbouring villages. These initiatives recognise cities as economic, educational, and cultural hotspots. Cities are viewed as engines of cultural life, as a repository for cultural heritage and events, and as sources of cultural identity and social transformation (Ekhaese & Adeboye, 2014). Conversely, several characteristics of cities like dense and diversified population, administrative complexity, overstretched facilities and decay, urban crime and traffic congestion, poor living conditions and overcrowding act as push factors to peri-urban development. These instigate the movement of residents from the downtown to peripheral urban areas where many physical development restrictions do not apply, thereby manifesting haphazard growth dubbed sprawl.

According to Aliyu & Amadu (2017), population progression particularly in developing nations has caused a rapid rate of urbanisation and subsequent growth of cities worldwide. Giuliano and Small (1991) then argued that comprehending the origin and growth of cities requires an understanding of employment, not just population. Substantiating, Oriye (2013) alluded that cities grow organically as a result of population increase induced by the inflow of commodities and services.

2.2 Concept of Urban Sprawl

The phenomenon of dispersed urban expansion dubbed 'urban sprawl' can be seen as a shift in urban settlement patterns and morphology. It demonstrates the dispersion of economic functions, spatial distribution, socio-spatial biases, political and cultural issues, and consolidates the growth of urban fringes (Tombolini et. al., 2015). It foreshadows the growth of more big urban areas that consume a greater proportion of available land area (Queslati, Alvanides, & Garrod, 2015), and expressing spatial development brought about by the interaction and translation of urban system activities (Wapwera, 2012). Sprawl is visible at the periphery of cities where low-density residential settlements have gradually displaced agricultural lands and woodland mosaics, resulting in a diverse and undefined landscape with a population that relies on private transportation (Ewing, Pendall & Chen, 2002; Tsai, 2005; Torrens, 2008).

Within the same metropolis, urban sprawl can take two drastically distinct forms: first, Fulton et al. (2001) identified urban sprawl as a low-income area characterised by extensive peri-urban areas with informal and unapproved land-use patterns, and scarcity of public infrastructure and services. This form of development could occur in areas with little or no focus on slum development, land use, services, and transportation. Second, Ewing (1994) reported urban sprawl as composed of residential zones for high and middle-income groups, significantly valued commercial and retail complexes, and well-designed highways connecting them through private rather than a public transportation system. Urban sprawl development is a fascinating geographical model that entails social, economic, and environmental concerns and represents the interaction of urban pattern and development processes (Frenkel & Ashkenazi, 2008; Orenstein, Frenkel & Jahshan, 2013).

Given the complexity of sprawl, it is challenging to comprehend how urban dispersion is structured through time and size (Kazepov, 2005; Couch, Petschel-held & Leontidou, 2007; Cassier and Kesteloot, 2012). This has complicated the execution of proper urban control methods and policies promoting sustainable land use (Bruegmann, 2005; Hall &

Pain, 2006; Angel et. al., 2011). Urban sprawl appears to be a problem in contemporary cities as a result of the prevalence of laissez-faire principles (Costa, Noble & Pendleton, 1991). UN-Habitat (2015) explained urban sprawl as the physical growth of a city's built environment which eats adjacent rural regions and is often characterised by low-density communities that rely on automobiles and frequently inadequate access to public infrastructure and services. As a result, urban sprawl may be inferred as unplanned, unregulated, and inefficient urban dispersion made up of few buildings and low population density.

2.3 Characteristics of Urban Sprawl

Ewing (1997) posited that inaccessibility is a frequent feature of urban expansion. Gillham (2002) highlighted four features of urban sprawl: leapfrog or dispersed growth, commercial strip development, low density, and wide stretch of single-use development. Also, urban sprawl may be identified by continuous networks of private properties separated by public roadways. On the other hand, Burchell et al. (1998) identified three major distinguishing attributes of urban sprawl as geographical patterns, causes, and effects. Low density, unrestricted outward growth, spatially separated land uses, leapfrog development, and extensive commercial strip development are all captured in the spatial patterns. From the foregoing, urban sprawl could be ascribed to poor central planning and a highly fragmented land-use control system. Galster et al. (2001) reported urban sprawl in eight dimensions: The first is density, which refers to the unit size of development; the second is continuity and extent to which undeveloped land has been intensively developed continuously. That is, sprawl may seem to be continuous in certain areas but discontinuous in others.

The third category is concentration, this is seen as the degree development is concentrated rather than distributed evenly, and the fourth category is clustering, which indicates that urban sprawl is often grouped and covers a tiny part of the corresponding geographical area. Furthermore, the fifth component is centrality whose loss portends grave urban sprawl problems. Nuclearity that describes the degree to which an urban region exhibits a mononuclear pattern of growth is the sixth dimension. The seventh of these dimensions is mixed-use land subdivision since urban sprawl seems to be a process of land use segregation; this is a division of housing, employment, amenities, and income within residential areas. Closeness which indicates the proximity of land uses is the eighth dimension, and a dearth of proximity often leads to many of the externalities associated with urban sprawl.

While the aforementioned features of urban stretch seem to be bad, some literature also discussed beneficial elements of urban sprawl. Burchell and Mukherji (2003) argued that urban sprawl has enabled individuals to obtain affordable single-family houses on vast swaths of land located distant from densely populated metropolitan areas with a high crime rate and poverty. Carruthers and Ulfarsson (2002) bolstered this argument by stating that urban peripheral development is more lucrative than inner-city redevelopment since developers are not required to remove existing buildings or upgrade surrounding infrastructure. A quick examination of the outlying regions of Benin City demonstrates the hallmark of urban sprawl, conspicuously, closeness to public amenities, leapfrog development, and low-density development.

2.4 Causes of Urban Sprawl

Urban sprawl may be instigated by a multifarious system of intermingling agents as a result of city expansion and strewn municipal intensification (Gargiulo-Morelli & Salvati, 2010). Inadequate physical planning control mechanism could impede effective urban planning, and permit the growth of sprawl. Giannakourou (2005) maintained that sprawl may be created by the exploitation of non-urban land, and facilitated by policies regulating urban and peri-urban development. This situation is supported by many interconnected variables, including reduced land prices, lower building costs, lower property taxes, and an increase in job opportunities at the outskirts of the cities. Thus, Glaeser and Kahn (2003) attributed urban sprawl manifestation to government policies such as highway supports, home mortgage interest deduction, inadequate financing of public services, and demand for enormous suburban lands. However, technology advancements, automobile connectivity, and smart public transit systems have enabled individuals to live in locations far from their places of employment and activities. This implies that individuals who relocate to the suburbs are mostly driven by a need for more living space to avoid overcrowded and tight urban environments.

2.5 The Compact City Concept

The compact city concept is a proposed solution to urban sprawl (Dieleman & Wegener, 2004; Ardeshiri, 2011). This approach is significantly different from the traditional urban development such that it emphasises urban intensification, limits urban expansion, promote mixed-use development, and deposits a higher premium on public transit and high-quality urban design. Compact city policies were vigorously adopted in the early 1990s by some planning authorities, especially in the United Kingdom and across Europe. They were related to sustainable development objectives and popularised by the 1987 Brundtland Report (Arbury, 2005). This suggests that the compact city concept allows for sustainability, and its polarisation is an indication of acceptability. It is a conception for implementing sustainable development within an urban context to discourage the alleged detrimental social, economic, and environmental consequences of sprawl.

Some works on urban design and planning have advocated for a more sustainable approach to urban environmental design and suggested the compact city model to avert and mitigate sprawl (Habibi & Asadi, 2011; Fertner, 2016; Shao et al.,2021). According to Burton (2002), a

compact city is considered a moderately dense mixed-use area with effective public transportation infrastructure and dimensions that promote walking and cycling. Thus, many urban sprawl-related issues could be addressed, and unsustainable developments reversed by the intensification of development within the metropolis. Compact cities can be achieved by strengthening existing cities, encouraging people to live in urban areas, and building at higher densities, because a primary goal of the compact city model is to mitigate the effects of urban development at the periphery (Williams, 1999). Compact city policies are mainly intended to minimise the patronage of private automobiles and preserve open space.

According to Thomas and Cousins (1996), a compact city's first impression recalls an intensive medieval metropolis with well-defined boundaries and a hive of activity contained inside the city wall. Stressing further, Lock (1995) saw the compact city as the practice of maximising land utilisation in urban areas before creating green spaces. However, the proponent of the idea asserted that metropolitan area expansion could result in just more than environmental advantages. More importantly, high-density communities are more likely to be socially sustainable because local infrastructure and services are evenly dispersed, and can easily be maintained (Williams, 1999), and access to products and services is within a minimum radius-of-reach. Compact living, in the same manner, could decrease travel time and costs between home and job.

Additionally, urban density is seen as a necessity for energy conservation, vibrancy, cultural activities, as well as social connection and cohesiveness (Bibri, Krogstie & Kärrholm, 2020). For instance, point-crime in a single multi-habited building could be easier to fight and curtailed than areas of sprawl growth. Similarly, congestion may be alleviated via segregation and an appropriate circulation system, and a cost-effective healthcare strategy inter alia. According to Olayiwola and Igbavboa (2014), the concentration of economic activity in the city centre draws market patrons from the periphery to the core, it is the spatial dispersion of diverse specialised products that drives the development of such regions. From the foregoing, cursory observation adduce four likely reasons for the development pattern at the fringes of Benin City viz; accessibility, low cost of land, nature of the land, and the impact of urban sprawl. The compact city concept has been proposed as a possible solution to urban sprawl.

III. MATERIALS AND METHODS

This section examines the location of the study area, socio-demographic characteristics, climatic conditions that could motivate sprawl development as well as the method adopted for the collection, analysis and presentation of data.

3.1 The Study Area

The Benin metropolis encompasses the local government areas of Oredo, Ikpoba-Okha, Ovia North-East, Uhunmwode, and Egor and is located at an elevation of 77.8m above sea level. It is found between latitudes $06^0$19'N and $06^0$21'N and longitudes $05^0$34'E and $05^0$44'E (Ogunbodede & Balogun, 2013). Benin City is a pre-colonial city that served as the previous headquarters of the Portuguese foreign mission and the international market for slave trafficking from the 13th to 19th century (Ikhuoria, 1984), as well as the capital of the defunct Mid-West and Bendel States as well as present Edo State. The City which is located in Nigeria's tropical rainforest region has a population of 1,086,882 (NPC, 2006) and is expected to expand to 1,837,329 (2021) at a growth rate of 3.5 percent. The rainy season in Benin City lasts from March/April to October/November with a brief dry period in August known as the 'August Break'.

The metropolis has grown rapidly as a nodal town connecting some cities in the west to those in the east of Nigeria, and others in the south to the northern part of the country. It is a commercial centre as a result of rural-urban migration, and its socio-cultural, economic, and political benefits. Significantly, Benin City is famous for bronze casting, the great Benin moat, and a plethora of traditions and cultures that serve as tourist attractions (Godwin, Peter & Alex, 2011). The above characteristics of Benin City have caused congestion, inadequate access to land, over-stretched infrastructure, housing shortage, and high cost of construction (Balogun & Onokerhoraye, 2017), which have exacerbated development at the fringes particularly along the transit route.

3.2 Methods

This research gathered data from primary and secondary sources and examined the six Local Government Areas that makeup Benin City. The primary data were obtained using a purposive random sampling method that incorporated the administration of two hundred and one questionnaires to selected heads of households on the outskirts of Benin City that were designated as sprawl communities. For two weeks, the thirty field assistants recruited (five for each of the Local Government Areas) administered the close-ended structure questionnaire. These were distributed in the evenings between 4:00 pm and 6:00 pm when respondents came home from the day's obligations. Data on the socio-demographic characteristics and spatio-physical factors responsible for the spatial expansion of the study area were gathered.

Two methods of data analysis were employed in this research in agreement with Wonnecott and Wonnecott (1979) and Ajayi (1990) that data analysis could involve multiple analytical techniques to facilitate the ease of communicating results and also improve its validity. The collected data were processed using the Statistical Package for Social Sciences (SPSS version 25) and analysed with Spearman Rho and point-biserial correlation tests presented in a table. The null

hypothesis was formulated that is; there is no relationship between the spatio-physical characteristics and urban sprawl in the study area. This was tested using multiple linear regression analysis also presented in tables. The analyses were supplemented with secondary data from current relevant literature sourced from textbooks, and journals from Google Scholar, Academia, and Researchgate databases.

IV. RESULTS AND DISCUSSION

This section discusses the results of the socio-demographic characteristics of inhabitants, the spatio-physical characteristics of the built environment, and the consequences of urban sprawl in Benin metropolis.

4.1 Socio-Demographic Characteristics of Respondents

For the heterogeneous characteristics of the variables, the point-biserial correlation test shown in Table 1 was developed. Gender, age, marital status, education, occupation, and income of respondents were classified as socio-demographic characteristics (Van Acker, Witlox, & Wee, 2007). A positive correlation ($r = 0.897$, $n=201$, $p \leq 0.05$) was computed between respondents' age and income, which was statistically significant at the $p \leq 0.05$ alpha level. The estimated relationship between occupation and income of respondents was $r_{pb} = 0.815$ statistically significant at $p \leq 0.05$, implying that higher occupational engagement (employment) increases income. The correlation coefficient between education and income variables was $r_{pb} = 0.813$, which was significant at $p \leq 0.01$. The positive correlation suggests that increasing educational standing would enhance one's income. Also, a positive correlation ($r_{pb} = 0.617$) discovered between income and gender characteristics was statistically significant at $p \leq 0.05$. Furthermore, the coefficient between income and married status indicated a statistically significant positive association of $r_{pb} = 0.604$ at $p \leq 0.05$.

Table 1: Correlation Results of Socio-Demographic Characteristics' Variables

Socio-Demographic Characteristics	Pearson Product Moment Correlation Test AGE	INCOME
AGE	1.000	0.897**
INCOME		1.000
	Point-Biserial Correlation Test	
GENDER	0.406**	0.617**
MARITA	0.547**	0.604**
EDU	0.859**	0.813**
OCCU	0.888**	0.815**

** Correlation is significant at the 0.01 Alpha level.
Source: Author's Fieldwork, 2021

4.2 Spatio-Physical Characteristics

Regression analysis of the physical and spatial patterns of development of the study area is presented in Tables 3, 4, and 5. This was done to investigate whether the spatio-physical patterns of the studied area were accountable for the sprawling growth. As spatio-physical factors; distance between buildings (DIS-BUILD), distance from home to the city centre (DIS-HOME), distance to the workplace (DIS-WORK), and distance between neighbourhoods (DIS-HOOD) were investigated.

Table 3: Anova of Spatio-Physical Pattern

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	383.355	3	127.785	229.791	0.000
Residual	109.550	197	0.556		
Total	492.905	200			

Dependent Variable: DIS-HOOD

Predictors: (Constant), DIS-WORK, DIS-BUILD, DIS-HOME

Source: *Author's Fieldwork, 2021*

The analysis of variance (ANOVA) presented in Table 3 reveals that the predictive model was statistically significant at $p < 0.05$ with $F(3, 197) = 229.791$

Table 4: Regression Analysis of Spatio-Physical Pattern

	Unstandardized Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-1.865	0.249		-7.490	0.000
DIS-BUILD	0.304	0.146	0.073	2.081	0.039
DIS-HOME	1.751	0.203	0.808	8.627	0.000
DIS-WORK	0.068	0.111	0.057	0.615	0.539

Source: *Author's Fieldwork, 2021*

Looking at the influence of the distance between buildings, distance from home to the city centre, and distance to the workplace on the distance between neighbourhoods of the residents, the empirical model estimates were formulated;

DIS-HOOD = -1.865 + 0.304 (DIS-BUILD) + 1.751 (DIS-HOME) + e …… (1)

The unstandardized coefficient (Table 4) for the distance between buildings was 0.304 statistically significant at $p \leq 0.05$. This implies that for an additional unit to the distance between buildings of residents in the study area, an increase of 0.304 variations was predicted on the distance between neighbourhoods. Hence, for every unit increase in distance between buildings (0.304), a similar increase in distance between neighbourhoods by 30.4% coefficient of determination (r^2) was predicted. Similarly, distance from home to the city centre, an increase of 1.751 statistically significant at $p \leq 0.05$ was predicted on the distance between neighbourhoods. This means that the rise in distance from home to city centre caused an increase of 1.751 in distance between neighbourhoods in the study area.

Table 5: Model Summary of Spatio-Physical Pattern

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.882	0.778	0.774	0.74572

Predictors: (Constant), DIS-WORK, DIS-BUILD, DIS-HOME
Source: *Author's Fieldwork, 2021*

The model summary in Table 5 reveals that the independent variables in the model; distance between buildings, distance from home to the city centre, and distance to workplace predicted a change in distance between neighbourhoods. The strong predictor for R-Square of 0.778 (77.8 percent) and an adjusted R-Square value of 0.774 suggest that the independent variables in the model accounted for 77.4 percent of the variance in the dependent variable (distance between neighbourhoods) statistically significant at $p \leq 0.01$. Thus, other unexplained components in the study area are left with a weak-fit model of 22.6 percent. The alternative hypothesis ($H_1 1$) is accepted based on the foregoing analysis because of the substantial relationship ($p \leq 0.05$) between spatio-physical characteristics and urban sprawl in the study area.

4.3 Implication of Urban Sprawl on the Study Area

Urban sprawl could have positive or negative effects on the urban environment but a lot of the adverse urban perils are attributable to the growth of sprawl. These negative consequences are often emphasised since urban sprawl is generally linked with an unregulated and unplanned type of growth. The implications of urban sprawl whether beneficial or detrimental are usually assessed based on socio-demographic and environmental effects (Bhatta, 2010). These effects may overlap and, in certain instances have many indirect consequences. Wassmer (2005) cited many negative implications of sprawl, including the automobile and its polluting impacts, non-functional open space, air, land, and water pollution, agricultural land loss, and the expense of duplicating infrastructure as witnessed in the outskirt of Benin City. Among the others are concentrated poverty, ethnoreligious and -racial and economic segregation, insufficient job prospects, excessive motorisation, and long-distance travel. Similarly, Seidentop (2005) found ecological, social, and health consequences, loss of agricultural land, increased commuting time and expenses, and flood menace as incidences comparable to those occurring in the study area.

Gillham (2002) emphasised how urban expansion destroys the natural habitats of many animals and plant species, putting them at risk of extinction. Arbury (2005) in the same vein, asserted that sprawl erodes social equality, results in the loss of community life, segregation, polarisation, and an inability to adjust to changing lifestyles and family patterns. Reduced land costs on the fringes of cities is another frequent reason for sprawl growth. Lower land prices at the outskirts of urban centres is another common cause of the development of sprawl. Land and rent values are highest at the central business district of Benin City and reduce as one moves outside towards the fringes. Additionally, the irregularity of well-tested planning rules results in urban sprawl, which separates zoning and produces isolated islands of various types of development. This problem is worsened by the dearth of transit facilities.

The bypass of Benin City from the Oluku junction on the Lagos road via the villages of Eyaen (Auchi road axis), Ovbiogie (Agbor road), Idogbo (Abraka road), and Obe (Sapele road) has resulted in practically unrestricted travel to the outskirts of the city as shown in Figure 1. Other significant concern of urban expansion in the study area is unplanned growth and ineffective urban planning procedures. Given that urban expansion occurs outside of urban administrative borders, there seem to be capacity limitations on the planning authorities' ability to appropriately oversee developers' compliance with town planning rules.

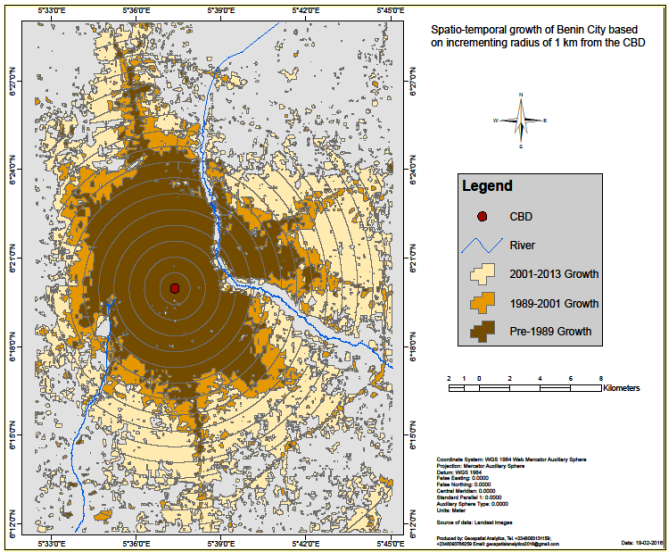

Figure 1: Spatio-Physical Growth of Benin City on an Incremental Radius of 1km

Source: Author's Fieldwork, 2021

V. CONCLUSION AND POLICY GUIDELINES

The findings indicated that the socio-demographic characteristics of the people, insufficient access to the central business district, and deficient transport infrastructure instigated urban sprawl rise in Benin metropolis. Furthermore, there is a relationship between the spatio-physical characteristics and urban sprawl in the study area, indicating that the spatio-physical pattern of Benin City was accountable for the sprawling growth.

The following recommendations are therefore suggested based on findings of the results to enhance the urban environment and guarantee a sustainable compact urban future in Benin City:

i. Urban expansion and development should be monitored on a steady basis using advanced remote sensing technology to gather data necessary for the

operationalisation of metropolitan planning and administration;

ii. The Ministry of Physical Planning and Urban Development (MPPUD) Edo State should develop a master plan that is sensitive to the changes occurring in the architecture and landscape of the metropolitan fringes;
iii. Land titles and building plans should be registered since the lack of a development permit complicates the monitoring of building construction and compliance with planning rules;
iv. The government should establish planning mechanisms to deter individuals and developers from building structures on the outskirts of Benin City;
v. Sites for amenities capable of attracting growth and development should be cautiously selected;
vi. Application of urban compact (Compact City Concept) that prevents leap-frog by intensifying urban districts through multi-habited housing and apartment blocks should be promoted in Benin City;
vii. Effective involvement in public transportation to promote urban mobility; and
viii. Utilisation and rehabilitation of existing built-up areas by flexible urban design methods and techniques.

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