

Reflections on the Impact of Urban Sprawl on the Architecture of the City: Lessons from Benin City, Nigeria

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Abstract

This paper focuses on Benin City, Nigeria, as a case study to explore urban sprawl and its associated problems resulting from unplanned and uncontrolled spatial expansion. Informal settlements house approximately 45% of Nigeria's urban population, leading to land and environmental challenges. The study aims to investigate how sustainable development goals can be realized through efficient, sustainable planning and urban design concepts, focusing on managing urban sprawl in the city. The methodology comprises a literature review, a field investigation of unplanned or squatter settlements in a selected part of Benin City through the administration of 201 questionnaires, and an analysis of its developments and physical transformations. Understanding the issues of urban sprawl arising from the rapid spatial expansion of Benin City is crucial for achieving a well-organized, planned, orderly, and sustainable environment. This paper provides valuable insights and information to facilitate effective urban planning in the study area. Additionally, it offers guidance to practitioners and developers on adopting sustainability measures in their projects. The findings of this study contribute to expanding the knowledge horizon and serve as a reference for further research on spatial expansion and the incidence of sprawl in urban centers throughout Nigeria.

Keywords: Informal settlement, planning, spatial expansion, sustainable development, squatter settlement, urban sprawl.

1. Introduction

Since the Urban Revolution till the present, low-density, unplanned residential areas have been found around most cities, indicating that urban sprawl is not a modern phenomenon. According to Tang *et al.* (2017), urban sprawl in China dates all the way back to the Ming Dynasty in the 14th century. Due to cultural and technical developments, urban sprawl has dominated cities in the developed world (Wolff & Wiechmann, 2018). Contrary to urban reality, where population density is high and buildings house multiple households together, the phenomena is typically connected with low-density settlements made up of individual dwellings (Tombolini *et al.* 2015; Ogundipe *et al.*, 2021). Both developing and developed nations worldwide experience urban sprawl, but there are differences in how it is generated and managed (Wapwera, 2012; Queslati, 2015). This difference arises from the fact that industrialized nations have procedures in place to monitor and manage development utilizing physical planning techniques that assist in situation management and support from the government. The situation in underdeveloped nations is substantially different. As a result, emerging nations are affected widely by the situation. For instance, according to recent studies, around 45 percent of Nigeria's urban population (Olayiwola and Igbo, 2014; Ogundipe, *et al.*, 2021) resides in unofficial communities.

Numerous land- and environment-related issues have been linked to the expansion of these unplanned communities. According to Orenstein *et al.* (2013), Odeyale and Kehinde (2015), and Natarajan (2017), urban sprawl is a fascinating spatial model that incorporates social, economic, and environmental issues as well as the interaction between urban patterns and development processes. It is challenging to comprehend how urban dispersion is constructed through time and size since sprawl is based on a number of interrelated elements (Kazepov, 2005; Couch *et al.*, 2007; Ciommi *et al.*, 2018). Adequate urban confinement methods and sustainable land-use management policies have become challenging to adopt (Gyau *et al.*, 2014). Because of the extreme levels of laissez-faire policies, urban sprawl seems to be a major problem for modern cities (Angel *et al.*, 2011; Taussig, 2017; Duvernoy *et al.*, 2018).

Measuring and defining urban sprawl are challenging tasks (Tong *et al.*, 2017; Wang *et al.*, 2019; Ismael, 2021). Several experts say density is the only sign of urban sprawl (Xu *et al.*, 2019). They are estimating the amount of developed land in counties using information from US National Resource Inventory surveys. According to Liu *et al.* (2018), density is defined as the population of a metropolitan region divided by the urbanized area. Their estimation of urban sprawl is based on the supposition that the more spread there is, the less dense the county is.



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Based on population migrations from cities to suburbs, land area increases vs population growth, time spent in traffic, and loss of open spaces, metropolitan areas are classified as more or less expansive (Bagheri & Tousi, 2018). According to Wu *et al.*'s (2021) study, the county sprawl index took into account six different factors, including the gross population density, the proportion of county residents who live in low suburban densities, the proportion who live in moderate or high urban densities, the population density in urban areas, the average block size, and the proportion of blocks whose areas are less than 1/100 square miles. Through the use of principal component analysis, these variables were integrated into a single factor that represented the extent of county sprawl, with the factor's mean value being 100 and its standard deviation being 25 (Rong, 2006; Lopez, 2012). The more compact the county is, the higher the county sprawl index value.

The study investigates how sustainable development goals can be realized through efficient, sustainable planning and urban design concepts, focusing on managing urban sprawl in the city. This study's significance lies in addressing urban sprawl challenges in Benin City, Nigeria, where informal settlements house nearly half the urban population. It offers insights into sustainable planning and urban design strategies to manage sprawl, contributing valuable information for urban development dynamics in rapidly expanding cities.

2. Research Methods

2.1. Study Area and Its Early History

Benin City is 200 miles east of Lagos by road and is situated in the tropical rainforest zone in the middle of southern Nigeria (Ekhaese, 2011), as shown in Figure 1. According to Ogunbodede and Balogun (2013), it is located between Latitudes 6° 26' N and 6° 34' N of the Equator and between Longitudes 5° 35' E and 5° 40' E of the Greenwich Meridian. Benin City is an important commercial hub and nodal town connecting Nigeria's western, eastern, northern, and southern regions. Due to its advantageous location as a gateway to the nation's four corners, the Benin City metropolitan area might be referred to as a "Golden Corridor" (Nkeki, 2016). The primary roadways in Benin City were built in a radial design from the city's center, King's Square, to other locations throughout the city. This radial route network from the city center improved communication between the central and surrounding areas. According to Ogunbodede and Balogun (2013), the most potent forest kingdom in West Africa had its capital in the ancient city of Benin, and its territorial domain went beyond the boundaries of the current Benin Division. As the headquarters of the Portuguese foreign mission, the hub of the slave trade, the center of international trade, the capital of the now-defunct Mid-west and Bendel States, and the current Edo state, Benin City is a pre-colonial city with roots dating back to the 12th century. According to the 2006 National Population Census, 1,086,882 people live in the city. Egor, Oredo, Ovia North-East, Ikpoba-Okha, and Uthmaniyah are the five local government areas the metropolis spans. The city has experienced enormous expansion in terms of both its population and geographic size.

According to the Columbia Encyclopedia, the Benin Kingdom was established around 1180 AD in the 10th century. The Ogisos, considered rulers from the sky, initially controlled the Edos, the empire's founders. According to Ekhaese (2011), the empire was ruled by roughly 31 Ogisos until the Oba assumed the role of supreme authority and head of state. In 1440 AD, the City-state changed its name to Edo Empire and became an empire. Between the 14th and 17th centuries, the empire spanned from Onitsha in the east through the present-day country of Ghana and the forested southwest of Nigeria (Ekhaese, 2011). According to Lang (2003), the Ga people of Ghana can trace their roots back to the former Benin Kingdom. According to studies by Ekhaese (2011), the metropolis is larger than 25,000 square kilometers, and some of its streets can be up to 37 meters wide, with houses arranged in carefully thought-out rows. Before the Portuguese arrived in the 15th century, it was reported that the kingdom had excellent home architecture. The Oba of Benin resided in a massive, stunning palace with spacious courtyards and columns embellished with the famed Edo-style ivory and bronze statues. Plaques adorned the walls surrounding doorways with exquisite carvings. The Edo people think their forefathers served as god's messengers and helped them converse with him. This explains why each traditional Edo home has a magnificently constructed ancestral shrine (Ekhaese, 2011).

The ancient inhabitants of the Benin Kingdom constructed walls and moats around the city to protect it from attackers. These moats and walls, currently recognized as UNESCO World Heritage Sites, extend for 1,200 kilometers and can reach 20 meters (Conah, 1972). King Square served as the city's center, laid out in a grid-iron arrangement similar to that of Renaissance cities. The traditional shrine, the museum, the Oba Market, and the palace of the Oba are all located in this

center (Ekhaese, 2011). As the homes go from the kingdom's center to the edges, their ages decrease sequentially from 300 to 200 years, 100 to 10 years. According to Omoigui (2005), Benin City, which is mostly found in the middle of Nigeria, can be thought of as a unified group despite having different identities. The ancient Benin Kingdom is the origin of several groups in Nigeria. This explains why these communities have a common language and culture.

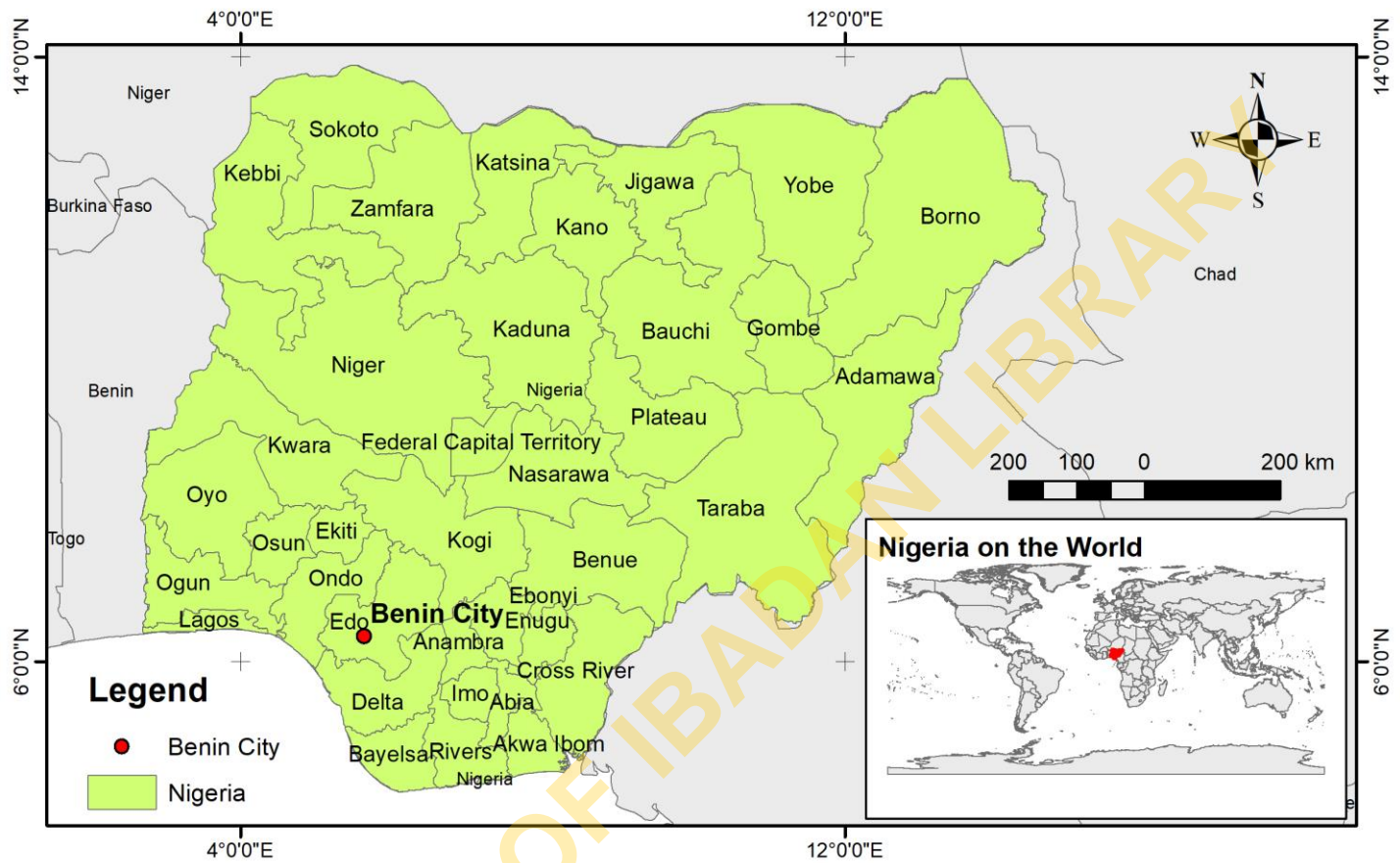


Figure 1. Present-day Nigeria, showing the Position of Benin City.

Despite their level of education, Ekhaese (2011) asserted that the Edos have a fairly traditional outlook and way of living. He stated that the strong belief in their customs and varied types of devotion binds the Edo people together. This has given the state both spiritual and temporal authority, but contemporary religious beliefs swiftly weaken the royal leadership of the fast state. Due to this development, modern architectural styles are starting to appear in the city's newest developments and outlying areas of Benin (Ekhaese and Ediae, 2014). According to Dmochowski (1990), the social structure of the Benin Kingdom was highly regarded. Ekhaese and Ediae (2014) asserted that the Benin Kingdom is preminent in maintaining its cultural identity among the complex of ancient kingdoms and empires that make up modern-day Nigeria. He continued by saying that while some of its cultural components have changed due to certain factors, others are still going strong.

3.2. Statistical Analysis

In order to accomplish the study's stated goal, data from both primary and secondary sources were employed. Copies of the questionnaire were distributed to gather information mostly on urban growth and infrastructure development. 201 questionnaires were distributed for this investigation using a rigorous random sample procedure. The demographic information about the respondents, the variables driving Benin City's spatial expansion, and the environmental effects of Benin City's growth were all obtained through the questionnaire. In order to identify the principal locations with cases of urban sprawl development, the city was stratified based on the five local government areas of the larger Benin City that were chosen (Egor, Oredo, Ovia North-East, Ikpoba-Okha, and Uhumwode; see Figures 1). Based on the population density of the designated areas, questionnaires were distributed. Ikpoba-Okha local government district was chosen at several places because it contains most of the area that makes up Benin City. The respondents were chosen at

random from the places mentioned. The administered surveys' recovered copies were examined in order to :

- i. Determine what is causing Benin City's expansion.
- ii. Identify the places that have been swallowed by urban growth as well as those that would be if the current rate of expansion is maintained.
- iii. Consider the planning consequences and determine if the adequate infrastructure was keeping up with the spatial growth.

The second set of data contained ;

ii. Population statistics for Benin City were gathered from the Edo State Office of the National Population Commission (NPC), Benin City, to support the attribute data for the research.

ii. Clear multi-temporal and multi-spectral Landsat images of Benin City from two time periods separated by ten years (2000, 2010, and 2020) are available. This categorization uses two time periods (2000–2010 and 2010–2020) to detect total land use change based on urban footprint analysis. The multi-temporal satellite data has the following spectral properties: the Landsat 8 optical sensor-OLI (Operational Land Imager) was used to resolve the 2020 Landsat image; the Landsat 7 ETM+ (enhanced thematic mapper) was used to capture the 2000 images. A spatial resolution of 30 meters (m) is included in each image. They were from and analyzed in Google Earth Engine. Machine Learning-based approach was used to classify the land cover. We classify the area by built-up and built-up using a random forest classifier.

The study utilizes a mixed-method approach to analyze urban sprawl in Benin City. The built-up area's growth over different periods highlights a significant increase in the built-up area and sprawl occurrence. Socioeconomic characteristics of respondents are correlated using Pearson and point-biserial correlation tests, revealing associations between variables such as age (AGE), income (INCOME), gender (GENDER), marital status (MARITA), education (EDU), and occupation (OCCU). The study employs chi-square tests to establish relationships between socioeconomic characteristics and urban sprawl variables like access (ACCESS), energy use (ENERGY), housing type (TYPE), attraction (ATTRACT), satisfaction (SATIS), development permits (DEVEL), and traffic congestion (TRAFFIC). The Spearman rho correlation test assesses connections between variables such as such as energy use (ENERGY) and housing type (TYPE), attraction (ATTRACT) and satisfaction (SATIS), attraction and traffic congestion (TRAFFIC) and satisfaction (SATIS) and traffic levels (TRAFFIC). These findings underscore the need for ongoing geospatial monitoring for effective urban planning and management.

3. Results and Discussion

According to Odjugo *et al.* (2015), Benin City's growth pattern did not adhere to a particular theory of urban growth. It is more of a synthesis of the key elements of the sector, many nuclei, and concentrated zone theories of urban expansion. According to Olayiwola and Igbavboa (2014), the type and geographical pattern of urban sprawl in Benin City fall into theories of urban structure such the multiple-nucleus theory, sector theory, and concentric zone theory. Burgess' 1925 Concentric Zone Theory postulated that cities expand in zones away from their centers. The expansion of Benin City expands outward from the City Center, following the main thoroughfares as it does so, and swallowing up the neighboring villages in the process.

The concentric idea is supported by the growth trend seen in Benin City. The Hoyt Sector Theory, which was put forth in 1936, says that cities develop in sectors instead of concentric zones. According to the Multiple-nuclei theory first forth by Harris and Ullman in 1945, comparable activities are clustered in some districts and drive the growth of those districts rather than cities growing in zones and sectors (Odjugo *et al.*, 2015). Between 2002 and 2013, the city's area increased from 339 square kilometers to 359 square kilometers, according to their observations. Three distinct growth periods in Benin City were found by studies by Olayiwola and Igbavboa (2014). The results were based on research by Ikhuoria (1984) that followed Benin City's expansion and development between 1900 and 1987. According to research, between 1980 and 1987, Benin City's built-up area accounted for roughly 14.79% of all land use.

The built-up area of Benin City is seen to have grown to 22.53% of the total land area by the time between 1988 and 2000, which is an increase of 7.74% over that of the period between 1980 and 1987 (see Figure 2). Figure 2 shows the recent phases of growth in Benin City, Nigeria. The built-up area of Benin City increased to 50.51% of the total land area between 2001 and 2008. This

demonstrates an increase in the built-up area's growth and an increase in the occurrence of sprawl at the periphery. Table 1 displays the findings of the correlation analysis for the respondents' socioeconomic characteristics. The age and income of the respondents were correlated using the Pearson moment correlation test, and the result was a positive coefficient ($r = 0.897$), which was statistically significant at the $p 0.01$ alpha level.

Table 1. Correlation Results of Socioeconomic Characteristics' Variables.

Socioeconomic Characteristics	Pearson Product Moment Correlation Test	Income
AGE		
INCOME	1.000	0.897**
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.

Table 2. Chi-Square Test Relationship of Socioeconomic Characteristics' Variables.

Socioeconomic Characteristics	MARITA			EDU			OCCU		
	Pearson Chi-Square Value	df	Asump. Sig.	Pearson Chi-Square Value	df	Asump. Sig.	Pearson Chi-Square Value	df	Asump. Sig.
GENDER	201.000 ^a	5	0.000	114.868 ^b	4	0.000	42.021 ^c	4	0.000
MARITA				179.262 ^d	20	.000	117.633 ^e	20	.000
EDU							357.514 ^f	16	.000

(a). 8 cells (66.7%) have an expected count of less than 5. The minimum expected count is .14. (b). 4 cells (40.0%) have an expected count of less than 5. The minimum expected count is .56. (c). 5 cells (50.0%) have an expected count of less than 5. The minimum expected count is 1.18. (d). 4 cells (40.0%) have an expected count of less than 5. The minimum expected count is .43. (e). 25 cells (83.3%) have an expected count of less than 5. The minimum expected count is .08. (f). 10 cells (40.0%) have an expected count of less than 5. The minimum expected count is .68. Source: Author's Fieldwork.

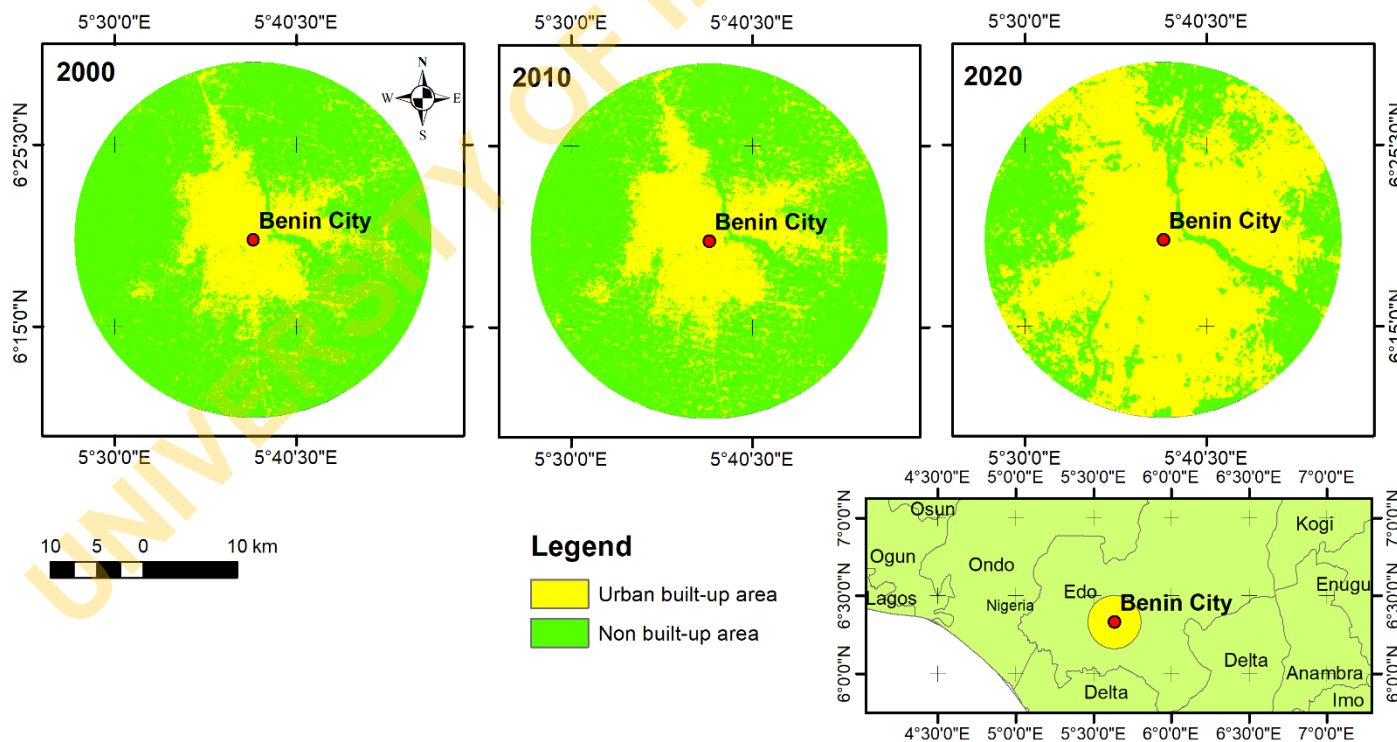


Figure 2. Phases of Growth in the recent past of Benin City, Nigeria from 2000 to 2020.

Point-biserial correlation analysis of Table 2 revealed that the relationship between respondents' occupation and income was statistically significant at $p 0.01$ ($rpb = 0.815$). According to the

respondents' (n = 201) strong positive association between occupation and income, more employment generally results in higher income. Similarly, the association between education and income variables was statistically significant at p 0.01 (rpb = 0.813). The correlational pattern suggests that increased educational involvement raises income. Additionally, a positive connection between the variables of income and gender was discovered, with rpb = 0.617 being statistically significant at p 0.01. Additionally, there was a positive association between income and marital status, with rpb = 0.604 being statistically significant at p 0.01. II. Therefore, it is necessary to periodically monitor the urban growth and extension of the city using modern geospatial technologies as this will aid in the collection of data required for effective urban planning and management of the city.

The percentage of respondents with a valid development permit before starting their construction project is shown in Table 3. One hundred seventy respondents (84.6%) did not have valid development permission when they started the construction of their buildings, according to a table analysis. Thirty-one respondents (15.4%) reported having a current development permit. The coefficients of the correlation between variables related to urban sprawl in Benin City are shown in Table 3.

Table 3. Chi-Square Test Relationship of Socioeconomic Characteristics' Variables.

Urban Sprawl Variables	ACCESS	ENERGY	TYPE	ATTRACT	SATIS	DEVEL	TRAFFIC
ACCESS	1.000	0.457**	0.503**	0.342**	0.363**	0.625**	0.286**
ENERGY		1.000	0.932**	0.443**	0.396**	0.580**	0.619**
TYPE			1.000	0.473**	0.445**	0.635**	0.589**
ATTRACT				1.000	0.904**	0.125	0.716**
SATIS					1.000	0.112	0.640**
DEVEL						1.000	0.175*
TRAFFIC							1.000

** Correlation is significant at the 0.01 Alpha level.

* Correlation is significant at the 0.05 Alpha level.

Source: Author's Fieldwork

According to a Spearman rho correlation test, the correlation between the variables of respondents' energy use and type of housing was $r_s = 0.932$, which is statistically significant at p 0.01. This demonstrates that the amount of energy used depends on the respondents' type of home. The association between respondents' attraction to the research location and their degree of pleasure was found to have a coefficient of $r_s = 0.904$, which is statistically significant at p 0.01. As a result, a location's level of satisfaction affects its appeal. Similarly, the correlation between respondents' attraction and traffic congestion in the research area is $r_s = 0.716$, which is statistically significant at the p 0.01 alpha level. This shows that the likelihood to produce traffic congestion increases with the level of attraction. The coefficient of correlation between respondents' levels of satisfaction and the amount of traffic in the research region produced a correlation of $r_s = 0.640$, which is statistically significant at the level of p 0.01 alpha.

3. Conclusion

According to the findings of this study, people who live in sprawling areas are more likely to own single-family detached homes than attached or multi-family homes, and they also tend to expect to own large homes. In recent decades, most metropolitan places around the world have witnessed the process of expanding. Between 1979 and 2013, the urbanized area in the study region grew alarmingly quickly, with the majority of the development occurring along the main transportation corridors heading into and out of the city. The additional area needed to accommodate this growth resulted in increased energy use as well as higher costs for the provision of infrastructure and social services. Uncontrolled land use development, particularly at the peripheries, is a significant issue that resulted from the growth of urban sprawl in Benin City. This type of development has a number of drawbacks, including inadequate transportation infrastructure, increasing traffic congestion, and difficult access to newly built places. Benin City's urban planning is being drastically altered by the growth of urban expansion, which is consuming and ruining fertile agricultural land that can never be replaced.

In particular for policymakers, practitioners, and urban planners, attention should be paid to the following proposals and suggestions to encourage sustainable development in developing nations. First, promoting the adoption of urban compact forms to stop urban sprawl, to increase the density of urban areas, to promote sustainable development, and to keep cities livable. Second, by

implementing policies that have a favorable effect on agricultural earnings, prime agricultural lands on the edges of cities can be preserved as open spaces and for environmental preservation. Thirdly, creating a favorable climate for efficient land use and urban planning legislation. Fourth, creating an updated master plan for the local development authority (Edo State Ministry of Housing and Urban Development) that takes into account the city's changing urban design. The majority of building owners do not possess valid development permits, which makes it difficult to monitor adherence to planning requirements. As a result, making registration of land titles and building designs mandatory. The sustainable urban development that will result from these actions will be significant.

References

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Author Contributions

Conceptualization: Timothy Oluseyi Odeyale; **methodology:** Timothy Oluseyi Odeyale; **investigation:** Timothy Oluseyi Odeyale; **writing—original draft preparation:** Timothy Oluseyi Odeyale; **writing—review and editing:** Timothy Oluseyi Odeyale; **visualization:** Timothy Oluseyi Odeyale. Author have read and agreed to the published version of the manuscript.

- Angel, S., Parent, J., Civco, D., Blei, A. and Potere, D. (2011). The dimensions of global urban expansion: Estimates and Projection for all Countries, 2000 – 2050. *Program Planning Journal*. Vol 75. doi : 10.1016/j.progress.2011.04.001.
- Bagheri, B., & Tousi, S. N. (2018). An explanation of urban sprawl phenomenon in Shiraz Metropolitan Area (SMA). *Cities*, 73, 71-90. doi : 10.1016/j.cities.2017.10.011.
- Ciommi, M., Chelli, F. M., Carlucci, M., & Salvati, L. (2018). Urban growth and demographic dynamics in southern Europe: Toward a new statistical approach to regional science. *Sustainability*, 10(8), 2765. doi : 10.3390/su10082765.
- Couch, C., Petschel, G. and Leontidou, L. (2007). *Urban Sprawl in Europe: Landscapes, Landuse Change and Policy*; Blackwell, London, UK.
- Dmochowski, Z. (1990). An Introduction to Nigerian Traditional Architecture. *Ethnographica*, 2, 1-3.
- Duvernoy, I., Zambon, I., Sateriano, A., & Salvati, L. (2018). Pictures from the other side of the fringe: Urban growth and peri-urban agriculture in a post-industrial city (Toulouse, France). *Journal of Rural Studies*, 57, 25-35. doi : 10.1016/j.jrurstud.2017.10.007.
- Ekhaese E. N. (2011). Domestic Architecture in Benin City: A Study of Continuity and Change, an unpublished *Ph.D. Thesis* in the Department of Architecture, School of Environmental Science, Covenant University, Ota, Ogun, Nigeria.
- Ekhaese, E. N. and Edia, O. J. (2014). From Home Owners Perspective, "Ikun Concept" of Design in Benin, Nigeria: Some Like It Some Don't, *Journal of Architecture Research*. 4(1). *Architecture Research* 2014, 4(1): 20-34. doi: 10.5923/j.arch.20140401.03.
- Ezra, K. (1992). *The Kingdom of Benin in the Nineteenth Century*. Royal Arts of Benin: The Pearls Collection in The Museum of Art. New York: Harry N. Abrams Inc.
- Frenkel, A. and Ashkenazi, M. (2008). Measuring Urban Sprawl: How can we deal with It? *Environmental and Planning Bureau*. Vol 35. doi: 10.1068/b32155.
- Gyau K., Awuah B., and Hammond F. N. (2014). Determinants of low land-use planning regulation compliance rate in Ghana. *Habitat International*. Volume 41, Pages 17-23 (January 2014).doi: 10.1016/j.habitatint.2013.06.002.
- Henderson, J. V., Nigmatulina, D., & Kriticos, S. (2021). Measuring urban economic density. *Journal of Urban Economics*, 125, 103188. doi : 10.1016/j.jue.2019.103188.
- Ikhuoria, I. A. (1984). Rapid Urban Growth and Urban Landuse Pattern in Benin City. In P.O. Sada and A.B.Osirike (ed), *Case Studies in Migration and Urbanization in Nigeria: Perspectives on Policy Issues*, Benin City.
- Ismael, H. M. (2021). Urban form study: the sprawling city—review of methods of studying urban sprawl. *GeoJournal*, 86(4), 1785-1796. doi : 10.1007/s10708-020-10157-9.
- Kazepov, Y. (2005). *Cities of Europe: Changing Contexts, Local Arrangement, and Challenge to Urban Cohesion*. Blackwell, Oxford, UK.
- Lang. (2003). *Edgeless Cities Exploring the Elusive Metropolis*. Brookings Institution Press, Washington, D.C
- Liu, Z., Liu, S., Qi, W., & Jin, H. (2018). Urban sprawl among Chinese cities of different population sizes. *Habitat International*, 79, 89-98. doi : 10.1016/j.habitatint.2018.08.001.
- Lopez, R. (2012). *Building American Public Health: Urban Planning, Architecture, and the Quest for Better Health in the United States*. New York, Palgrave Macmillan. doi : 10.1057/9781137002440.
- Lopez, R. and H. P. Hynes. (2003). "Sprawl in the 1990s: measurement, distribution and trends". *Urban Affairs Review* 38(3): 325-355. doi: 10.1177/1078087402238805.
- Natarajan. L. (2017). Socio-spatial learning: A case study of community knowledge in participatory spatial planning. *Progress In Planning*, Volume 111, January 2017, Pages 1-23. doi: 1016/j.progress.2015.06.002.
- Nkeki, F. N. (2016). Spatial-Temporal Analysis of Land Use Transition and Urban Growth Characterization in Benin Metropolitan Region, Nigeria. *Remote Sensing Applications: Society and Environment*, 4, 119-137. doi : 10.1016/j.rsase.2016.08.002.
- Odeyale, T.O. and Kehinde, O. (2015). Millennium Development Goals: Impact of Sustainability Discourses, Conflict and Inter-Governmental Actions in the Built Environment. *International Journal of Engineering and Technology Research* (IJETR), vol 5, no.2, Pp.95-108. (ISSN 2329-7309).
- Odeyale, T.O. (2010). Cultural Metamorphosis, Building Tradition and Search for Architectural Identity in Africa: A Case Study of Southwest Nigeria. In Deependra Prashad (ed.) *New Architecture and Urbanism: Development of Indian Tradition*. Newcastle upon Tyne: Cambridge Scholars Publishing, pp.61-72.
- Odjugo, P.; Enaruvbe, G. and Isibor, H. (2015). Geospatial Approach to Spatio-temporal Pattern of Urban Growth in Benin City, Nigeria. *African Journal of Environmental Science and Technology*. Vol. 9(3), 166-175. doi : 10.5897/AJEST2014.1715.
- Ogundipe, K. E., Ogunbayo, B. F., Olofinnade, O. M., Amusan, L. M., & Aigbayboa, C. O. (2021). Affordable housing issue: Experimental investigation on properties of eco-friendly lightweight concrete produced from incorporating periwinkle and palm kernel shells. *Results in Engineering*, 9. doi : 10.1016/j.rineng.2020.100193.
- Ogunbodede, E. F., & Balogun, T. F. (2013). An integrated remote sensing and GIS approach in monitoring urban expansion in Benin City, Nigeria. *International Journal of Scientific and Engineering Research*, 4(5).

- Olayiwola, A. and Igbavboa, O. (2014). Land Use Dynamics and Expansion of the Built-Up Area in Benin City, Nigeria. *Mediterranean Journal of Social Sciences*. MCSER Publishing, Rome-Italy. doi: 10.5901/mjss.2014.v5n20p2506.
- Omoigui, I. (2005). How to improve youth development in Edo state, a keynote presentation on excellence in education and culture for the new millennium, 14th Annual National Convention of the Edo National Association of USA and Canada. *On the first report of the SFHA*, San Francisco Housing Association 13(1): 6.
- Orenstein, D., Frenkel, A., Jahshan, F. (2014). Methodology Matters: Measuring urban spatial development using alternative methods. *Environment and Planning B*. Vol 41. doi : 10.1068/b38017.
- Osadolor, O. B. (2001). The Military System of Benin Kingdom, c.1440 – 1897, *PhD Thesis* in the Department of Philosophy and History University of Hamburg, Germany.
- Rong, F. (2006). Impact of Urban Sprawl on U. S. Residential Energy Use. Unpublished *PhD Thesis*. School of Public Policy, University of Maryland, U. S. A.
- Queslati, W., Alvanides, S. and Garrod, G. (2015). Determinants of Urban Sprawl in European Cities. *Urban Studies Journal*, vol. 52 (9), Pgs. 1594-1614.
- Tang, W., Zhou, T., Sun, J., Li, Y., & Li, W. (2017). Accelerated urban expansion in Lhasa city and the implications for sustainable development in a Plateau City. *Sustainability*, 9(9), 1499. doi : 10.3390/su9091499.
- Taussig, M. (2017). *Mimesis and Alterity: A Particular History of the Senses*. London: Routledge.
- Tombolini, I.; Zambon, I.; Ippolito, A.; Grigoriadis, S.; Serra, P.; Salvati, L. (2015). Revisiting “Southern” Sprawl: Urban Growth, Socio-Spatial Structure and the Influence of Local Economic Contexts. *Journal of Economic* Vol 3. doi : 10.3390/economies3040237.
- Tong, L., Hu, S., Frazier, A. E., & Liu, Y. (2017). Multi-order urban development model and sprawl patterns : An analysis in China, 2000–2010. *Landscape and Urban Planning*, 167, 386–398. doi : 10.1016/j.landurbplan.2017.07.001.
- Wang, J., Qu, S., Peng, K., & Feng, Y. (2019). Quantifying urban sprawl and its driving forces in China. *Discrete Dynamics in Nature and Society*, 2019, 1-14. doi : 10.1155/2019/2606950.
- Wapwera, S. (2012). Spatial Planning Framework for Urban Development and Management in Jos Metropolis, Nigeria. *PhD Thesis*, School of the Built Environment, College of Science and Technology, Salford University, Salford, UK.
- Wolff, M., & Wiechmann, T. (2018). Urban growth and decline: Europe’s shrinking cities in a comparative perspective 1990–2010. *European urban and regional studies*, 25(2), 122-139. doi : 10.1177/0969776417694680.
- Wu, T., Yang, S., Liu, M., Qiu, G., Li, H., Luo, M., & Jia, P. (2021). Urban sprawl and childhood obesity. *Obesity reviews*, 22, e13091. doi: 10.1111/obr.13091.
- Xu, G., Dong, T., Cobbinah, P. B., Jiao, L., Sumari, N. S., Chai, B., & Liu, Y. (2019). Urban expansion and form changes across African cities with a global outlook: Spatiotemporal analysis of urban land densities. *Journal of Cleaner Production*, 224, 802-810. doi : 10.1016/j.jclepro.2019.03.276.