Environmental Sustainability In Lagos Periphery Housing

Funmilayo Mokunfayo Adedire Dr.
Lead City University, Ibadan, funmidire@gmail.com

Michael Babatunde Adegbile Dr
University of Lagos, Akoka, Lagos, mboadegbile@yahoo.com
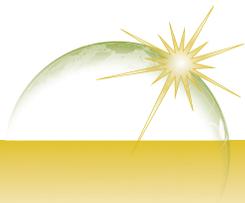
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ABSTRACT: Peri-urban residential settlements in Nigerian cities grew phenomenally as a result of rapid urbanisation. But the spontaneous housing settlements are enmeshed in development-driven urban challenges. This study examines the environmental sustainability of a typical peri-urban settlement in Lagos, Ikorodu. A combination of case study based examination and application of International Urban Sustainability Indicators List framework (IUSIL) was used to achieve an integrated research method. Data were collected through primary and secondary sources including observation, structured questionnaires, interview and satellite images. Two stage clusters sampling was used to select 384 household heads as the study population. Quantitative data was done using descriptive analysis while satellite image analysis was used for qualitative data. Investigations were carried out on the state of infrastructure, locational quality and the commuting pattern. Findings show fair environmental sustainability as evidenced by access to public water services, effective transportation system. There was residents' satisfaction in areas of fresh water, less reliance on automobile and effective transportation system which culminates in less commuting hours in the study area. Dissatisfaction was recorded over inadequate drainage system, poor waste management, resulting in poor environmental quality. Also noted was deviation from the master plan, zoning was not adhered to thereby causing noise pollution due to encroachment of manufacturing industries on residential areas. These findings can be a useful template for all stakeholders in enabling sustainability of emerging settlements in Lagos cities' periphery.

I.   INTRODUCTION

Sustainable interventions are best applied during the creation of built environments than at a later stage when changes might be difficult (du Plessis, 2007; Ding, 2008). Therefore, the inability of the national and state government in meeting basic human needs will not only affect human well-being, but will also impact negatively on long-term social and environmental sustainability (Basiago, 1999). Generally in developing countries, sustainability is of little priority thus translating to poor communication of global sustainability agenda to the stakeholders (du Plessis, 2007). Following investigation by du Plessis (2007), notable barriers to the success of prior sustainability agenda in developing countries of which Nigeria is one are, lack of data, poverty, disinterested stakeholders, unstable economic

environment and undue dependency on foreign codes and standards which are not fit for local application.

The direct influence of urbanisation in the study area, Ikorodu, has been phenomenal. It is the most urbanised peri- urban settlement in Lagos State (Lagos State Ministry of Housing, 2016). Most environmental challenges in Lagos periphery can be attributed to the unprecedented population growth leading to a pull on the limited infrastructure and the eminent collapse of public facilities (Lawanson, 2005). Though there is a recent review in the master plan of the study area, the spatial expansion and the accompanying urban demand has outgrown provision made in the original plan (Lagos State Ministry of Physical Planning & Urban Development, 2015). Environmental sustainability is affected by disparity in infrastructure development, boundary disputes, and lack of compact urban form leading to inefficient land use, high cost of commuting and reduced human productivity in Lagos peri-urban interface (Jabareen, 2006 ; Adedire & Adegbile, 2018).

Success in urban sustainability globally has been attributed to adoption of functional and relevant sustainability indicators to mitigate local challenges (Kamp *et al*; 2003; Sahely *et al*; 2005). Indicators are set of parameters for benchmarking performance. They assist in maintaining focus in development strategies, promote local participation, and help in achieving set sustainability target (Winston & Eastaway, 2008; Moldan, Janousková & Hak, 2012). Therefore, this paper examines the environmental impact of development in Ikorodu on human well-being and their productivity. There is a need for development of indicators to address the sustainability challenge form the perception of the residents and other relevant stakeholders in the study area.

II. THE REVIEW OF LITERATURE

As housing challenge continues to acerbate in Lagos metropolis, development of housing under different schemes in cities peripheries but predominantly self-built housing is the major perceived solution (Adedire & Adegbile). The continuous urban population constituting mainly the low income group can only be accommodated in the peri-urban interface where there is housing affordability due to availability of land for residential development (Lawanson, Yadua, & Salako, 2012). Also, the improvement in the area of transportation development has encouraged more households to seek for residential and workplace location in Lagos peri-urban settlements as is experienced in other developing nations (Acheampong & Anokye, 2013; Dutta, 2012).

However, the sustainability of the rapid urban transition in most cities' periphery in Africa is questionable. The ambiguity of space in most peri-urban interface is a great challenge for sustainable development (Adell, 1999). It is argued by that the interface must be space-specific to overcome challenges confronting its healthy development (Allen, 2003; Allen, 2010). Also fragmentation of governance in African cities is a major bane of sustainable development (Cadène, 2005). The gradual collapse of the local government which has a direct role to play in shaping developmental pattern through active and effective political and economic institutions, is a point of underdevelopment of emerging new towns in cities periphery (Aribigbola, 2011; Wu, Zhang, & Webster, 2013). City primacy in Nigeria, especially Lagos has resulted in unbalanced distribution of the development process and mostly the neglect of the peri-urban (Towry-Coker, 2002).

Sustainability does not only measure urban ability to outlive present development, it involves ecological implication of development, land use pattern, quality of life, community inclusiveness and compactness of urban form to reduce reliance on use of automobile (United Nations Habitat, 2004). Also, the European Commission (2006), defined urban sustainability as the challenge to solve

both the problems experienced within cities and the problems created by cities. Sustainability brings urban and rural together with links at the national and global levels (Shen *et al;* 2011).

Notable environmental challenges to sustainability in most developing countries are pollution and the resources implication and unbalanced settlement pattern impacting negatively on infrastructure development (Camagni, Gibelli, & Rigamonti, 2002). The limitation in economic capacity of the peri-urban dwellers in having a standard and acceptable quality of life, thus reducing satisfaction, place a demand on the governing institutions in provision of basic amenities for urban use (Cuthill, 2010).

Most peri-urban settlements lack sustainable land use. There are limited inhabitants per kilometer square. This form of dispersed settlements calls for high cost of infrastructure development. There are undesirable artificial surfaces as a percentage of the total municipal area (Camagni, Gibelli, & Rigamonti, 2002). In general, most peri-urban in developing countries are not planned (Jiboye , 2011; Dutta, 2012). They are products of spontaneous change in land use and mostly before planning interventions, constituted by informal developments. Another challenge to environmental sustainability in developing countries is the lack of timely update of the area master plan leading to development outpacing infrastructure provision (Marans, 2014).

Contributing also to urban sustainability is the development of public transportation to reduce dependency on the use of private cars thus eliminating traffic congestion and in return improved health and well-being of the residents. Linkages either in the form of urban to rural links, peri-urban to rural or peri-urban to peri-urban links play pivotal role in the functionality of the peri-urban interface (Iaquinta and Drescher 2000). In terms of transportation, in most Nigerian cities'

periphery, the secondary roads linking dispersed settlements to the secondary roads are not as developed as the principal commuting routes. The poor state of roads in the peri-urban leads to high commuting hours for urban residents living in the inner periphery settlements (Adedire, 2018).

Investigating the environmental challenges of peri-urban settlements in Lagos mega city, Lawanson, Yadua, and Salako (2012) identified security and poor infrastructure problems. Poor spatial planning in the peri-urban interface is a contributing factor to hindered infrastructure development in the area. Additional noted challenge in the peri-urban interface, is traffic congestion. There exist poor air quality as a result of poor waste disposal facilities and industrial emissions (Binns, Maconachie, & Tanko, 2003). In the peri-urban interface, waste water services are limited to public housing. Most Self-built housings lack drainage and hence discharge waste water directly to the surrounding thus causing air pollution (Obeng & Whittal, 2014). Also some housing development suffer from noise pollution due to close proximity to manufacturing companies.

Sustainability entails the involvement of local participation in decision making to enhance a result-driven urban policies (Cadène, 2005). Central to the success of any sustainability programme is the consideration of the socio demography of the local citizens (Dempsey, Bramley, Power, & Brown, 2009). Urban sustainability in Nigerian peripheral settlements including Lagos is far from being a success (Uzonwanne, Iregbenu, & Ezenekwe, 2015). Hence, global improvement in urban sustainability has been achieved by developed countries through the adoption of sustainability indicators. Reliable and realistic indicators do not only guide in achieving the desired urban sustainability but measure performances and give indications of lapses in policy (Huang, Wong, & Chen, 1998; *Shen et al;* 2011, Moldan, Janousková, & Hák, 2012).
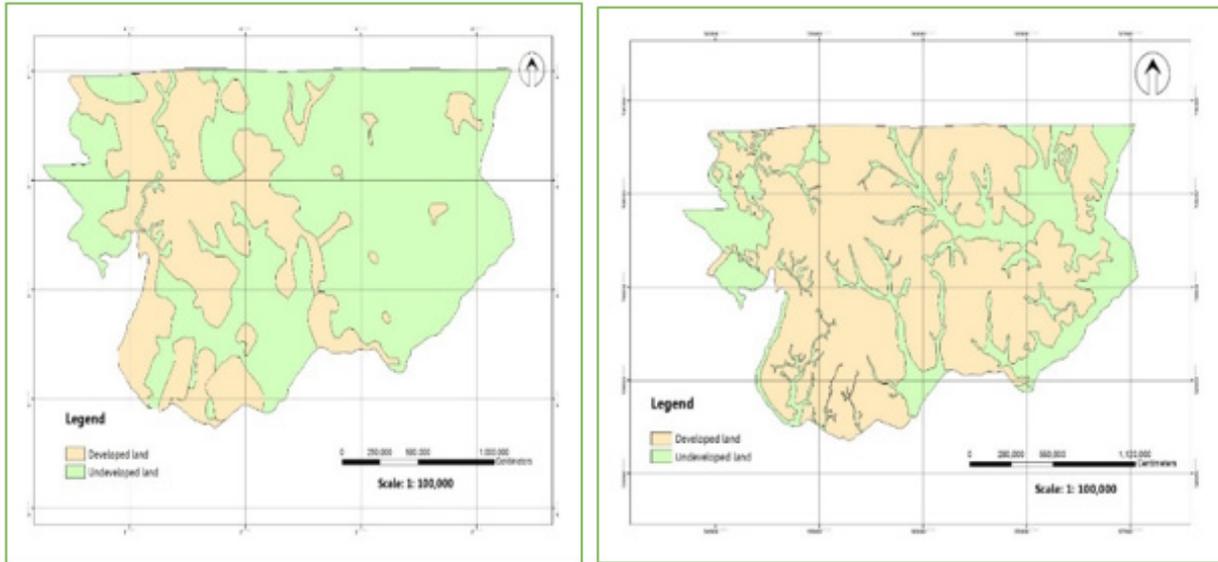
Figure 1: A Map showing improvement in urban development of Ikorodu between 2006-2016.
(Source: Google Earth Archive, 2006, 2016).

III. STUDY CONTEXT.

The opening of the peri-urban interface for housing development is an ongoing urban decongestion exercise to control overcrowding and the collapse of urban infrastructure by the increasing population in Lagos (Lagos State Ministry Of Housing, 2016). Among the five notable peri-urban interfaces in Lagos which include Ikorodu, Alimosho, Badagry, Ibeju-Lekki and Epe (Towry-Coker, 2002; CPMS, 2005), Ikorodu, a municipality in Lagos State has received an impactful urban development lately as indicated in Figure 1.

Ikorodu Local Government, covering 345 km^2 is situated at approximately 36km north of Lagos and located in the North East of Lagos State along the Lagos lagoon. Ikorodu had an enumerated population of 535,619 in 2006 (National Population Commission, 2009). According to Lagos State Ministry of Physical Planning (2015), spatial growth of Ikorodu has been at the annual rate of 118.3% from 1990-2011 and as at 2015. Ikorodu population at estimate of 706,100 is 0.388% of the total population of Nigeria. Ikorodu population in 2016 was estimated to be 768,562.

One of the major successes towards the reform of Ikorodu peri-urban interface is the just concluded new development plans. Marking a departure from the inherited master plan from the colonial era, and gearing for urban reformation, there is a new development plan to cover 20 years from 2016 -2036. This incorporates local interest, aligns with local culture, embraces public participation and positively promote sustainability agenda of Lagos State government (Lagos State Ministry of Physical Planning and Urban Development, 2015). The growth of peri-urban settlements in Ikorodu, the study area is aided with the development of Ikorodu urban corridor and additional feeder roads.

Ikorodu has both location-specific advantages and challenges that makes it ideal for sustainability study in Lagos State. It has grown phenomenally due to rapid and continuous expansion of relatively central parts of Lagos mainland like, Ojota, Ogudu, Ketu and Magodo. The selection of this study area is to promote integration of Ikorodu

peri-urban settlements to the Lagos metropolis by collection of empirical data for improved interventions in areas of sustainability.

IV. RESEARCH METHODOLOGY

This study employed the integrated research method where case study examination and international sustainability indicators were employed in sourcing for data. Document survey was carried out on the existing master plan and the satellite images of the study area generated with GIS. Two-stage clusters sampling was adopted in selection of the sample size. In order to save cost and time, probability sampling technique was used. Firstly, 18 settlements were purposively selected from 94 peri-urban settlements in the study area. Thereafter, 384 housing units were selected randomly from clusters of 18 settlements, chosen from the 6 districts in Ikorodu for balanced data collection. To achieve high return rate, the administration of the questionnaires were done during non-working days and hours and also on the spot collection system was adopted. Respondents were not allowed to choose multiple answers in the survey questionnaire. Out of the total of 384 questionnaires administered to household heads as primary respondents, 379 questionnaires were retrieved. Data processing and analysis for this study were performed using the Statistical Package for Social Sciences (SPSS) 22 for windows for statistical analysis of the quantitative data. On the quantitative data, two types of analysis were performed. Descriptive statistics were used to generate the percentages and frequencies of respondents' socio-demographic profile, commuting patterns and whether housing were gated or not to measure the level of residential segregation. Data on respondents' perception on urban sustainability was collected using the international urban sustainability indicator list (IUSL). The qualitative data, a sets of satellite images of year 2006 and 2016 were obtained from Google Earth archive using Geographic Information Systems

Table 1: Household heads' socio demography

Variables		N=379	%
Tenure	Less than 5 years	139	36.7
	5-10years	142	37.5
	More than 10 years	97	25.6
	Others	1	0.3
Monthly income of household head	Low income ($70-$140)	150	39.6
	Middle income ($140-$420)	178	46.9
	High income ($420)	51	13.4
Literacy level of Household Head	Postgraduate	25	6.6
	BSc/Higher diploma	124	32.7
	National diploma	79	20.8
	Secondary	130	34.3
	Primary	18	4.7
	None	3	0.8

Field survey (2017).
* Salary grouping is culled from the Federal Republic of Nigeria's Federal Civil Service Commissions

Table 2: Environmental Sustainability Indicators

Environmental Sustainability Indicators		Respondents' satisfaction on Sustainability (%)		
		% Satisfied	% Not Satisfied	Indifferent
En1	Geographically balanced settlement pattern	27.5	45.5	27
En2	Freshwater	80.7	19	0.3
En3	Wastewater/ Drainage	18.5	80.2	0.6
En4	Quality of ambient air / environmental quality	22.4	77.6	0
En5	Noise pollution	25.1	73.1	1.8
En6	Sustainable land use/Less reliance on automobile	72.8	26.9	0.3
En7	Waste generation and management	26.4	72.8	0
En8	Effective transportation systems	83.9	15.6	0.5
En9	Effective master plans	25.3	74.7	0
En10	Less commuting hours	72	27.4	0.5
En11	Biodiversity	0	0	0

Source: Field survey, 2017.
*Indicators extracted from IUDSL-Shen, Ochoa, Shah, & Zhang (2011).
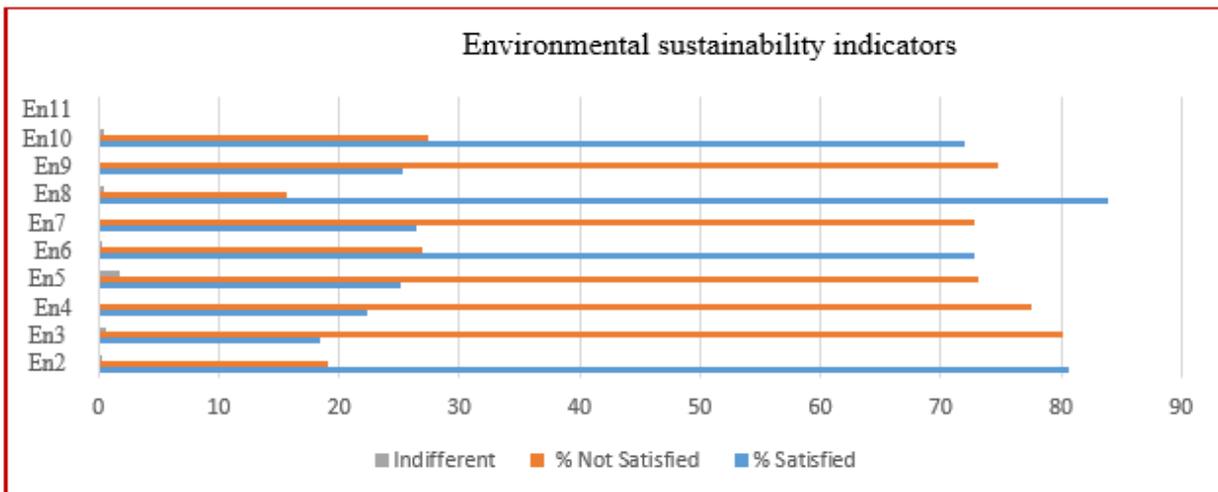

Figure 2: Respondents' environmental sustainability indicators.

V. RESULTS AND DISCUSSION.

5. 1 Socio demography of respondents in the study area.

According to the survey analysis in Table 1, in terms of tenure, the longest time most people have lived in the study area was within a period of five to ten years. The low income group with 25,000.00-50,000.00 ($70-$140) monthly earning was 39. 6% of the respondents. The middle income group, earning between N50, 000.00 to N150, 000.00($140-$420) monthly were the most predominant. 46.9% of the total population sample was composed of this group. High income group, earning 150,001-above ($420) were just 13.4% of the population. Illiteracy level, which according to UNESCO means education below secondary school level constitutes is 5.5%.

5.2: Environmental sustainability from respondents' perception.

The survey analysis presented in table 2 shows the satisfaction of the respondents with selected environmental sustainability criteria in the study area. The percentage of respondents satisfied with the settlements pattern was 27.5%, this represent those that believed that the settlements were well planned. However, 45.5% indicated their dissatisfaction and claimed the settlements were unplanned while 27% were indifferent to the settlement pattern. Treated freshwater was adequately provided for about 80.7% of the respondents but 19% were denied access to public clean water while 0.3% did not signify whether they were satisfied or not. The most regular source of

Table 3: Commuting Pattern and Reliance on Automobile.

Pattern of commuting	N=379	%
Average daily commuting time		
Less than 30 minutes	118	31.1
31-60 minutes Within 1hr	116	30.6
61-90 minutes	51	13.5
91-120 minutes	63	16.6
121-180 minutes	22	5.8
Others	6	1.6
Missing numbers	3	0.8
Purpose of commuting		
Work	206	54.4
Groceries	88	23.2
Supply for business	77	20.3
Others	2	0.6
Missing System	6	1.6
Automobile ownership		
Yes	160	42.2
No	214	56.5
Neither	5	1.3

Source: FIeld survey, 2017.

water in the study area is borehole water system dispensed through taps, other sources of water are well and streams. In terms of waste water and drainage system, these seem to be big deficiencies as recorded by 80.2% dissatisfied households. Only 18.5% of the respondents were satisfied with provision of covered drainage system while 0.6% did not indicate their opinion about this indicator. Generally, most self-built housing developments in Lagos peri-urban settlements lack good drainage system. This often result in flooding and environmental pollution in the residential areas. However, this is not the case with public and PPP residential developments. Appropriate drainage systems were installed in these types of housing. Also, the lack of suitable drainage systems contributes greatly to vehicular congestion especially during rainy season hence causing high commuting time and reduced productivity. There is a developed transportation system in Ikorodu. 83.9% respondents show their satisfaction with this indicator as opposed the 15.6% that indicated their dissatisfaction with the transportation systems. The high satisfaction recorded could be attributed to the provision of BRT (Bus Rapid Transit) and the continuous development of the primary service routes linking the peri-urban settlements to the surrounding Lagos metropolis. There is also an alternative provision of waterways for linkage to other parts of Lagos urban areas.

Although there is an ongoing improvement on the master plan, existing ones were not updated as shown by the opinions of 74.7% of the respondents. The privileged few of 25.3% perceived to be living in well planned government reserved area shows satisfaction with the master plan. The improved transportation system translates to satisfaction in commuting hours as shown by 72%. However, 27.4% were dissatisfied with their daily commuting hours. Further analysis on commuting pattern is presented in section 5.2.1 of this paper.

On biodiversity, there was no success on extraction of data from the respondents as they seemed not to have good understanding of this indicator.

5.2.1: Respondents' pattern of commuting and reliance on automobile.

As shown in Table 3, the commuting pattern reveals that 31.1% of the respondents spend less than 30 minutes on daily commuting to work, 30.6 % spend 60 minutes, 13.5% commute within 90 minutes, 16.6 % between 61 minutes to 180 minutes, 5.8 % spend about 180 minutes and 1.6 % had unspecified commuting time. The purpose of commuting further shows that 54.4% of the respondents' commute to the city for work, 23.2% for groceries, 20.3% for supply of their medium scale businesses and 0.6% for other needs. Private car ownership reveals that 42.2% of the respondents' had personal vehicles while 56. 5% do not and 3% not specified.

VI. CONCLUSION AND RECOMMENDATION.

Based on findings in this study, there exist generally a higher dissatisfaction than satisfaction with environmental sustainability. Among the 11 indicators examined, satisfaction were only on 4 namely less commuting hours, effective transportation, less reliance on automobile and access to public water services. While this shows a fairly compact urban form, it also connotes that development of transportation is at the trade-off of other infrastructure in the study area. A regular update of the master plan would enhance a more balanced settlement which in return will aid in better and more effective distribution of public amenities. In line with Boamah (2014) findings, the health related indicators like waste generation and management, waste water, drainage and environmental quality need to be seen to enhance the quality of life of the residents and also to minimise health related chal-

lenges in Lagos peri-urban settlements.

The commuting pattern (Table 3) shows a high level of linkage to the city from Ikorodu peri-urban and shows a strong connectivity and the dependence of the peri-urban settlements on the metropolis especially for employment. This signifies a weak economic sustainability of the study area as shown by regular commuting. There is also a need to make the urban form more compact to reduce the hours of commuting as this affects not only the well-being of the residents but also their productivity as earlier revealed by (Boamah, 2014). Although, there is an indication of satisfaction in areas of production, water affordability, and transportation linkages in the study area,

In conclusion, the engagement of tested sustainability indicators in this study has helped in revealing the weaknesses in the environmental sustainability of Lagos peri-urban settlements. These findings could be a useful information for the policy makers and all stakeholders in creating a more sustainable development though synergy and concerted efforts. It could be a useful template for creating a balance in the three arms of development goals. It is recommended that improvement by the state and local government in areas of public housing would foster more effectiveness in planning and distribution of infrastructure. The level of informality which is measured by the availability of information on regularisation of housing development, building permit in this case is an indication that predominant housing type in the study area, the self-built housing could not give high satisfaction to the peri-urban dwellers.

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