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Evaluating the sustainability of urban housing development in Nigeria through innovative infrastructure management

Austin Otegbulu and Yewande Adewunmi
Department of Estate Management, Faculty of Environmental Sciences, University of Lagos, Akoka, Yaba, Lagos, Nigeria

Abstract

Purpose – This paper aims to determine the sustainability of housing development in the context of neighbourhood infrastructure provision and also to examine the level of averting cost and substitutes resorted to by households in the study areas.

Design/methodology/approach – A total of 80 questionnaires each were distributed and retrieved from households in Festival of Arts and Culture (FESTAC) town and Badia, Lagos, Nigeria. The questionnaire design was based on a combination of an extensive review of literature dealing with the economic impact of urban infrastructure on the citizens of Lagos metropolis. All respondents returned completed questionnaires in a usable format, representing a 100 per cent response rate.

Findings – Infrastructure provision is not sustainable in the study areas. This is based on the fact that infrastructure provision in the study areas is deplorable and in consequence households are willing to pay for its improvement.

Research limitations/implications – Sustainability is a goal that allows for continuing improvement of standards of living without irreversible damage to resources need to survive as that humans species. It therefore implies that housing development has to be designed in a sustainable manner with due regard to its neighbourhood. This is reinforced by the fact that housing development cannot be sustainable without neighbourhood interactions and cost-efficient infrastructure management.

Originality/value – Review of sustainable urban services is needed to curb slum formation and deteriorating housing conditions in urban neighbourhoods. This will be a veritable tool in urban housing and infrastructure management.

Keywords Sustainable development, Housing, Physical planning, Nigeria

Paper type Research paper

Introduction

In a civilized society, housing represents more than roof cover but includes both internal and external services. In most third world countries, sustainable housing is more of luxury than a right to the extent that people sleep under bridges and live in shanties that constitute an affront to human dignity. According to Abrams (1964), housing is not just shelter, but part of the fabric of neighbourhood life and of the whole social milieu; it touches upon many facets of industrialization, economic activity and development. By implication, it encompasses the immediate environment, sanitation, drainage, recreational facilities and all other economic and social activities that make life worth living. Demand for housing in real world necessarily embodies demand for places, to access for public and private services, and reflects the fact that housing is in part a positional good (Hirsch, 1976). Urban infrastructure and housing provision are interwoven. Without infrastructure, housing cannot be sustainable and hence should be treated integrally. An ideal urban neighbourhood should be provided with good road and drainage networks, electricity and portable water supply, good waste management system, security, etc. However, the condition of these services in our urban neighbourhoods contradicts the principle of sustainability in urban housing.

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Up till 1981, there was no water transportation plan for the whole of Lagos metropolitan area. It is recently that the government developed an urban transportation plan. Electricity supply is epileptic and when electricity does not work, water cannot flow. The condition in most housing estates and residential neighbourhoods are deplorable and leave much to be desired. Sustainability is a far cry. At this point, we can define sustainable development as development that meets the economic needs of the present without compromising the ability of the future generation to meet their economic needs. Housing in this paper will be treated as a part of urban residential neighbourhood. According to Churchill and Baetz (1999), sustainable neighbourhood design involves the development of communities with considerations to environmental, social and economic goals in a balanced perspective. Lack of sustainable urban services is a good catalyst for slum formation and deteriorating housing conditions in urban neighbourhoods.

In Nigeria, residential neighbourhoods are not only a place of living, but also a place of work. Most residents especially earn their living where they live and depend greatly on the availability of infrastructure for their daily income. Without this income, they will not be able to pay their bills or feed their family. The houses where they live will in addition be poorly maintained and without sanitation.

The aim of this paper is to determine the sustainability of housing development in the context of neighbourhood infrastructure provision. The objectives to achieve this are as follows:

- To determine the infrastructural conditions in selected neighbourhoods of Lagos metropolis.
- To ascertain substitutes by residents of the neighbourhoods in view of the poor state of infrastructure.
- To determine the amount spent by the residents on providing alternative infrastructure.
- To determine willingness to pay for improvement in infrastructure in the neighbourhoods by the residents.

Previous studies

The incorporation of sustainable neighbourhood design is important because many of the problems encountered at the macro city scale are in fact cumulative consequences of poor planning at the micro-neighbourhood level. Neighbourhood-scale analysis is necessary to evaluate and develop more efficient and sustainable local urban infrastructure including buildings, transportation and urban vegetation and water (Sample *et al.,* 2001). The role of infrastructure in urban housing and residential neighbourhoods need not be over emphasized. One major difference between a slum dweller and a non-slum dweller is urban service. When urban services fail, residents try to provide alternative service or restore existing ones. These are done both communally and individually. Water and sewer services are built mainly to provide safe drinking water; to treat sewerage, to meet waste water standards and to reduce related health risks. Some communities are compelled to build new system or expand/improve existing ones to meet new regulation. However, many communities invest in water/sewer facilities to encourage economic growth by facilitating the expansion of existing business as well as attracting new ones (Bagi, 2002). This is an indication of its economic importance.

Infrastructure

The multifaceted nature of infrastructure sustainability objectives requires engineers to adopt a holistic approach in infrastructure design. In addressing the sustainable neighbourhood design problem, it is necessary to define infrastructure in a broad manner. In line with the above, Hudson *et al.* (1997) defines infrastructure as combined facilities that provide essential public services of transportation, utilities/water, gas electric, energy, telecommunications, waste disposal, sports and recreational facilities. Generally, infrastructure systems are not treated as combined facilities but rather are designed independently by specialists in individual areas of specialties (e.g. road and drainage, water distribution, transportation, etc). Such specialists may lack an understanding of how all the infrastructure system interact as a whole. Therefore to achieve sustainable neighbourhood design, those involved in the neighbourhood design process must consider the interaction among local infrastructure and systems and between the neighbourhood and the greater urban region (Engel-Yan *et al.,* 2005). These interactions are very essential for good performance and sustainability of urban infrastructure. In Nigeria urban cities, these interactions are not considered, for example roads are built without good drainage system. The result is that the roads do not last more than one rainy season. Road designs and capacity do not put into consideration the volume of traffic and intensity of use. Housing estates are designed and developed without provision for adequate infrastructure. In some situations, only one road leads to an area with very large population to the extent that vehicular movement becomes a nightmare. Under poor road conditions, traffic is stagnated and hoodlums seize the opportunity to rob car owners and passengers. Pipe borne water provision in urban area cannot be efficient with epileptic power supply. In some residential estates, every space is paved with concrete or asphalt without provision for water percolation and this result in prolonged flooding in the affected areas. A typical example is Dolphin Estate Ikoyi Lagos.

In addition to poor infrastructure interaction, the condition of infrastructure in Nigeria is just bad. According to Mabogunje (1973: 3-6), Nigerian cities are places for which nobody cares, where environmental degradation is evident, where refuse and solid waste litter the roads, where the state of infrastructure facilities is everywhere disappointing, where roads are in a very advanced state of disrepair and total negligence of drains and sewers (see Figures 1 and 2). All these, according to him, are as result of decades of mismanagement, corruption and citizens disempowerment which have blighted the early promises of Nigerian cities. In 2008, the situation has not changed.

According to 2006 world bank sponsored household survey in Lagos, 44 per cent of Lagos inhabitants relied on well/borehole as their main source of water supply, 12 per cent depended on public tap/stand pipe, 11 per cent use protected dug well, seven per cent use unprotected dug well and seven per cent depended on small scale vendors. Other sources like tanker trucks, surface water, lagoon, creek, rivers, dams, attracted only three per cent. The survey also revealed that 43 per cent of household experienced floods during rainy season in their respective street while 12 per cent claim to experience flooding in their houses. This is mainly due to poor drainage, and dumping of refuse into gutters and canals. The report showed that 83 per cent of households experienced unexpected interruption of power, while 47 per cent of households responded that they experience damage to household appliances.

Sustainability of housing development

It will be appropriate to define or explain the words sustainability and sustainable development. According to a special commission of the United Nations commonly

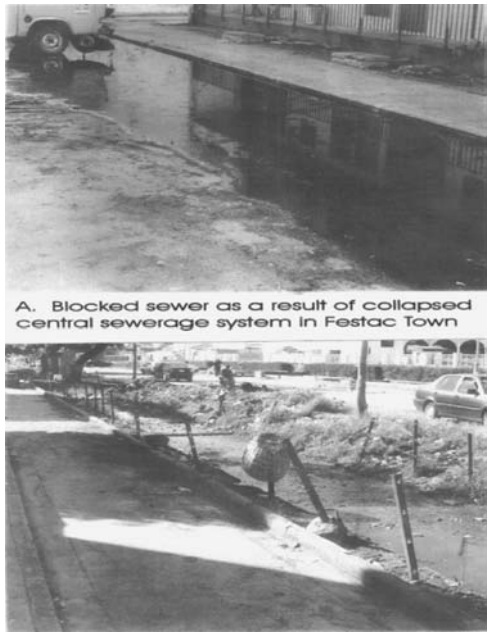


Figure 1.
Blocked sewer as a result of collapsed central sewerage system in FESTAC town

Figure 2.
Bad roads and drainage in Badia area of Apapa Local Government Area, Lagos

referred to as Bruntland commission, sustainability is a goal that allows for the continuing improvement of standards of living without irreversible damage of resources we need to survive as species. Sustainable development is a goal that meets the needs of the present without compromising the ability of the future generations to meet their own needs (World Commission on Environment and Development, 1987).

To work towards the creation of sustainable housing development, one must understand the environmental impact of infrastructure on buildings. The primary energy loads in buildings are created by lighting, space heating and cooling equipment and domestic water. One of the first considerations in designing a climatically responsive building is consideration of appropriate passive design strategies. Passive design refers to the creation of building elements and configuration that take advantage of the physical environment of a specific site to either heat, cool or ventilate a building. In addition to the above, the major elements that determine the performance of the building envelope are the windows, wall and roof assemblies. The insulation values and thermal mass of roofs and wall assemblies will have major effect on the thermal performance of a building (Lehrer, 2001).

Introduction of sustainable design or green building concept in our housing could be an innovative approach to managing the problem of infrastructure in Nigeria. The need for this is more pronounced in the power sector due to the disastrous condition of that sector. Some of the attributes of sustainable design (green building) are intrinsic to the building, such as material selection and indoor environmental quality. In some situations, the characteristics of green building overlap with many other neighbourhood elements. Some of these include installation of water conserving features, recovery of non-sewage waste water, and use of pervious paving around buildings which have obvious implications for the design of water, waste water and storm water infrastructure, respectively. The use of vegetation in neighbourhood design is also helpful as trees shade buildings and shield them from wind. Federer (1970) describes the effect of trees in modifying the urban micro-climate, which affect the comfort and building space energy use. Micro-climatic temperature is affected by radiation, convention and evaporative cooling. Trees affect the micro-climate through their effect on these processes. Federer (1970) considers shading to be the most important method by which trees affect the micro-climate. In locating trees, the orientation and distance between buildings are most important parameters.

The research survey

A questionnaire was undertaken to determine the economic impact of urban infrastructure in Lagos metropolis using environmental valuation techniques.

The questionnaire design was based on a combination of an extensive review of literature and dealing with economic impact of urban infrastructure on the citizens of Lagos metropolis. The questionnaire was distributed to 80 households in the study areas of Festival Town of Arts and Culture (FESTAC) and Badia in Lagos metropolis. The households were selected using systematic sampling method. Although the overall sample size could not be obtained from any available list, instead every fourth house on a street was selected from between 15 and 50 houses located on a street. All respondents returned completed questionnaires representing a 100 per cent response rate that had been pre-test and now in useable format. Questionnaires were completed by heads of households or their spouses to ensure that all the questionnaires are attended to even in the absence of a respondent.

The four page questionnaire was structured into three sections. The first section of the questionnaire aimed to identify some of the background of the respondents. The second section was on the personal background of the respondents. The second section focused on building types, rental income, age of buildings and building conditions. The third section examined the extent, cost and state of the following infrastructural facilities: electricity, water supply and roads and drainage.

The respondents were mainly female (45 per cent) in FESTAC. Most of them were self-employed (45.6 per cent), followed by civil servants (26.6 per cent), Bankers represent 16.5 per cent, unemployed 7.6 per cent, while others (3.8 per cent) came last. Majority of the residents in FESTAC surveyed earn between N31,000 and N50,000 (31.9 per cent), followed by 25 per cent that earn between N7,500 and N15,000. This implies that most of them earn average income. The dominant building was block of flats with a percentage of 43.8 and the least is the detached house with a percentage of 6.3.

In Badia, the respondents were mainly male (65.3 per cent). Most of them were self-employed (66.2 per cent), followed by unemployed (12.2 per cent) and civil servants (12.2 per cent), while 9.5 per cent were engaged in occupations not mentioned. Majority of them earn between N16, 000 and N30,000 (41.5 per cent), followed by those earning between N7,500 and N15,000 (29.2 per cent); 18.5 per cent earn below N7,500. Only 4.6 per cent earn between N31, 000 and N50,000 and 3.1 per cent between N51,000 and N75,000 and above. The low-income earning capacity of residents in the area explains the poor environmental conditions of the neighbourhood. The dominant building is the block of flats (40 per cent) and the least is bungalow (4 per cent). Like FESTAC a higher percentage are tenants (78.1 per cent).

Table I is designed to determine the stability of electricity in the study areas. Where the supply of electricity is erratic, it implies that the residents have to incur an extra cost on generators, kerosene, candles, rechargeable lamps, etc. The Table shows that respondents experienced erratic power supply.

Table II shows households that resort to cushioning the effect of poor power supply.

From the survey, 50 per cent of the residents in FESTAC while only 23.6 per cent of the residents in Badia incur extra cost in order to supplement electricity supply through the use of a generating set. FESTAC town households are more affluent. This justifies the high frequency on use of generators.

The average amount spent by residents in fuelling their generating set is N7,500 per month based on the highest percentage of 87.5 spending between N5,000 and N10,000 while, the average spent by residents in Badia for fuelling their generating set is N7,500 per month based on the highest percentage of 94.1 per cent spending between N5,000

Variables	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
Erratic	80	75	100	100
Constant	Nil	Nil	Nil	Nil
Total	80	75	100	100

Table I.
Stability of power supply

Variables	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
Yes	40	17	50	23.6
No	40	55	50	76.4
Total	80	72	100	100

Table II.
Household that owns generating sets

and N10,000 (see Table III). This cost is prone to the fluctuations depending on fuel price and frequency of outage. In addition, fumes from generators cause respiratory problem and also deface building walls.

An average sum of N3000 is incurred for maintenance by the residents. The survey shows that an additional amount of N10,500 in spent on fuelling and maintaining generating set per month which can be included in the rent paid only if electricity was stable (Table IV).

From the survey, an average sum of N30 is spent on a daily basis by residents to supplement electricity supply based on the higher percentage of 68 that spend between N20 and N40 (Table V). High demand for kerosene often leads to scarcity and adulteration of fuel by vendors.

This implies that an average of N750 is spent on kerosene weekly by the residents as indicated by a percentage of 84.3 per cent (Table VI). From both tables a total of N3,840 per month can be gained by the landlord that is via rent paid if only power supply was regular.

A higher percentage (57.3 per cent) of the residents in FESTAC is willing to pay extra rent for regular power supply. While a high percentage (53.5 per cent) of the residents in Badia are willing to pay extra for regular power supply (Table VII).

Table III.
Cost of fuelling generating set per month

Variables (N)	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
5,000-10,000	35	16	87.5	94.1
11,000-16,000	3	Nil	7.5	Nil
22,000-28,000	1	1	2.5	5.9
Above 28,000	1	Nil	2.5	Nil
Total	40	17	100	100.0

Table IV.
Maintenance of generating set

Variables (N)	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
5,000-10,000	25	15	62.5	88.2
11,000-16,000	13	2	32.5	11.8
22,000-28,000	2	Nil	5.0	Nil
Total	40	17	100	100

Table V.
Amount spent on candles

Variables (N)	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
20-40	33	44	66.0	63.8
50-70	12	20	24.0	29.0
80-100	4	4	8.0	5.7
Above 130	1	1	2.0	1.5
Total	50	69	100.0	100.0

The number of households that get regular supply of pipe borne water in FESTAC from the mains is small (13.0 per cent) compared with those that spend on extra cost to augment water supply from other sources (87 per cent). Also the number of households that get regular supply of pipe borne water from the mains in Badia is small (13 per cent) compared with those that spend on extra cost to augment water supply from other sources (87 per cent) (see Figure 3).

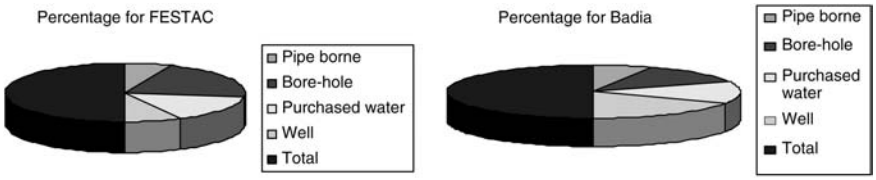
The average sum spent on purchased water by residents on a weekly basis is N750 and despite this extra cost one-third (33 per cent) of them are not satisfied with the quality of water they buy as some of them have suffered from one illness or the other due to the bad quality of water consumed (Table VIII). While from the survey an

Variables (N)	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
500-1,000	43	51	84.3	77.3
1,000-1,500	5	9	9.8	13.7
1,500-2,000	1	3	2.0	4.5
Above 2,500	2	3	3.9	4.5
Total	51	66	100	100.0

Table VI.
Amount spent on kerosene

Variables	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
Yes	39	38	57.3	53.5
No	37	33	48.7	46.5
Total	76	71	100.0	100.0

Table VII.
Those willing to pay extra for regular power supply



Notes: FESTAC; Pipe borne = 13 per cent, Borehole = 42 per cent, Purchased water = 30 per cent, Well = 15 per cent, Badia; Pipe borne = 13 per cent, Borehole = 24 per cent, Purchased water = 28 per cent, Well = 35 per cent

Figure 3.
Source of water supply

Variables (N)	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
500-1,000	28	21	85	77.8
1,000-1,500	3	6	9	22.2
1,500-2,000	1	Nil	3	Nil
2,000-2,500	1	Nil	3	Nil
Total	33	27	100.0	100.0

Table VIII.
Amount spent to purchase water

average sum of N750 is spent by the residents on purchased water and despite this extra cost 39.3 per cent of them are not satisfied with the quality of the water they buy as a majority (94.1 per cent) have suffered one illness or the other due to the bad quality of water consumed.

From the survey, residents in FESTAC suffer from typhoid fever after they consume purchased water or water from dug well and untreated boreholes, which implies that another extra cost is incurred to treat such illness. Also the survey shows that residents in Badia suffer from typhoid fever after they consume purchased water which implies that another extra cost is incurred to treat such illness (Table IX). While residents in Badia suffer typhoid fever after they consume purchased water which implies that another extra cost is incurred to treat such illness.

Table X shows the amount spent by households in both areas to treat water related diseases. FESTAC households spent an average of N8,654 per month while those of Badia spend monthly average of N5,840.

From the survey, only 55 per cent of the residents in FESTAC are willing to pay extra for a regular water supply. Only 61.3 per cent of the residents in Badia are willing to pay extra for a regular water supply (Table XI). This implies that people are willing to pay more for things they place more priority on.

The survey shows that 88.46 per cent of the roads in FESTAC town are tarred out of which 42.31 per cent are filled with potholes, which is rather high. This implies that residents may spend extra cost on motorcycle since buses and tanks may not ply the roads due to their bad state. Meanwhile, 64.8 per cent of the roads in Badia are tarred, out of which 43.2 per cent are filled with potholes, which is also high (Figure 4). This also implies that residents may spend extra cost on motorcycle since most buses may not ply the road due to the bad state. In addition, there will be incidence of car damage and punctured tyres due to bad roads.

Table IX.
Illness suffered from water borne disease

Variables	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
Typhoid fever	10	16	91	66.7
Cholera and dysentery	1	8	9	33.3
Total	11	24	100.0	100.0

Table X.
Amount spent on illness per month

Variables (X)	Frequency for FESTAC	Frequency for Badia	*F*(X) for FESTAC	*F*(X) for Badia
3,000	1	10	3,000	30,000
4,000	1	2	4,000	8,000
5,000	2	2	10,000	10,000
8,000	1	1	8,000	8,000
8,700	1	Nil	8,700	Nil
9,000	1	Nil	9,000	Nil
10,000	1	4	10,000	40,000
15,000	1	2	15,000	30,000
25,000	1	1	2,500	2500
30,000	1	Nil	30,000	Nil
Total	11	22	99,200	128,500

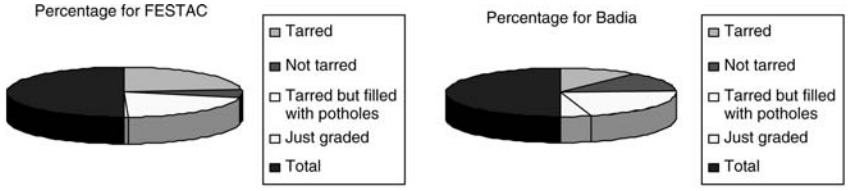
Despite the high percentage of drainages (73.1) most of the roads (58.4) are flooded after a storm, which implies an extra cost on maintenance of vehicles and on transportation which could have been included in the rent if there were good roads, while in Badia, despite the high percentage of drainages (77.3 per cent), most of the roads (72 per cent) are flooded after a storm (Table XII), which implies that an extra cost is spent on maintenance of vehicles and on transportation which could have been included in the rent if there were good roads.

In FESTAC, out of a total of 57 drainages, 65 per cent are dirty and blocked which implies that there is a high possibility of flood and high incidence of malaria and other diseases due to the presence of stagnated water – a good breeding ground for mosquitoes and other vectors. While in Badia, out of a total of 58 drainage, 87.9 per cent are dirty and blocked which implies that the area will also be prone to heavy flood and a high incidence of malaria and other diseases (Table XIII).

From the resident's perception, 49.4 per cent indicated that the general state of the sanitary and drainage system in FESTAC town is bad and only 14 per cent of them say it is good. This implies that a lot has to be done to provide a good environment for the residents as to spur them to pay more. While in Badia, as rated by the residents, 70.8 per cent of the sanitary and drainage system is bad and 22.2 per cent fair while 6.9

Variables	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
Yes	44	46	55	61.3
No	36	29	45	38.7
Total	80	75	100	100.0

Table XI.
Willingness to pay extra for regular water supply



Notes: FESTAC; Tarred = 46.15 per cent, Not tarred = 10.26 per cent, Tarred with potholes = 42.31 per cent, Just graded = 1.38 per cent, Badia; Tarred = 21.6 per cent, Not tarred = 27 per cent, Tarred with potholes = 43.2 per cent, Just graded = 8.2 per cent

Figure 4.
State of roads

Variables	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
Yes	45	54	58.4	72
No	32	21	41.6	28
Total	77	75	100.00	100.0

Table XII.
Roads prone to flooding

per cent is good (Figure 5). This implies that the entire system needs to be improved for residents to be willing to pay more.

From the survey, only 67.5 per cent of the residents in FESTAC are satisfied with the quality of the environment while 32.5 per cent are not. This implies that the quality of the environment is a little above average, which is fair compared with some other neighbourhoods in Lagos. Only 27 per cent of the residents in Badia are satisfied with the quality of the environment while a higher percentage of 73 per cent are not (Table XIV). This implies that the quality of the environment is poor, which must be improved upon.

Discussion and conclusion

The findings of the survey carried out in both in FESTAC town and Badia are clear on the economic impact of poor infrastructure provision on households in the study areas (see summary in Table XV). Households rely on informal sources for power and water supply and still pay electricity and water bills for services not provided. As indicated in literature residential homes often serve as places of work. In effect, when necessary infrastructure for work is constrained, household productivity declines with low consequent economic capacity. This in effect affects their ability to pay rent or maintain the buildings in a sustainable manner. Poor water condition is a guarantee for poor sanitation in homes.

Poor drainage and road condition are common failures in the study area and most parts of Lagos. Most places get flooded after heavy rainfalls due to blocked drainage facility.

Table XIII.
State of drainage

Variables	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
Dirty and blocked	37	51	65	87.9
Clean and flowing	20	7	35	12.1
Total	57	58	100.00	100.0

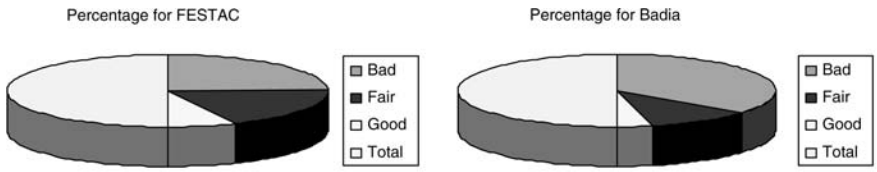


Figure 5.
General state of sanitary and drainage system

Notes: FESTAC; Bad = 49.4 per cent, Fair = 36.7 per cent, Good = 13.9 per cent. Badia; Bad = 70.8 per cent, Fair = 22.2 per cent, Good = 6.9 per cent

Table XIV.
Satisfaction with place of residence

Variables	Frequency for FESTAC	Frequency for Badia	Percentage for FESTAC	Percentage for Badia
Yes	54	20	67.5	27.0
No	26	54	32.5	73.0
Total	80	74	100.00	100.0

Electricity	Water	Road	Drainage
Encourages informal source of power like generators, candles and lanterns. Fumes from generators cause respiratory problems and deforms building walls. Use of candles causes fire incidences in homes while lantern heat leads to explosion. Poor electricity makes it difficult for water to be pumped from boreholes and dug well	Households use productive time trekking to fetch water. Poor quality water leads to water borne diseases and poor sanitation in homes	Slows traffic and damages cars. Increased cost of transportation and environmental deterioration	Blocked drainage or lack of it causes flooding and stagnation of bad water. It is also a fertile ground for mosquito breeding. Flooding also defaces walls and causes damage to household properties

Table XV.
Summary of infrastructure problems and sustainability

Sustained flooding leads to road deterioration with deep pot holes. This affects sustainability of road infrastructure. Cars get easily damaged due to bad roads and commuters are easily robbed when trying to meander through potholes. Productive time is spent trekking long distances to fetch water and huge sum of money is spent on treating water related diseases.

Residents realize the importance of infrastructure to their lives and hence are willing to pay for service improvement. Planting of trees and vegetation should be encouraged in the study areas to enhance a sustainable environment. Drainage should be cleared regularly to reduce flooding. Buildings should be designed with adequate lighting and ventilation facilities and also reduce dependence on electricity. Energy saving bulbs and power inverters should be encouraged to reduce averting expenditure.

The study indicates that the infrastructure condition in the study area is deplorable, with evidence that residents spend a lot of money to provide alternatives in addition to consequential damages suffered. There is equally evidence that the residents are willing to pay for improvements in infrastructure provision in the study areas. These show that housing development in the area lacks sustainability due to poor infrastructure conditions. Suggestions were also made on how sustainable housing could be achieved through creativity in building design and infrastructure interactions.

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Corresponding author
Yewande Adewunmi can be contacted at: yewande_adewunmi@yahoo.com