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Environmental Quality of Low Income Housing and its Impact on Sustainable Urban Development in Port Harcourt, Nigeria

Tamunoala Olivia AMGBARA

Institute of Geosciences and Space Technology,
Rivers State University,
Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria
tamunoalaoa@gmail.com

ABSTRACT
Urban places in Nigeria suffer systematic degradation due to paucity of funds and inconsistent adherence to planning regulations. This study examined the effect of environmental quality of low-income housing on sustainable urban development in Port Harcourt, Rivers State, Nigeria. The study used the *ex-post facto* research design because there was no manipulation of the variables. The study population included residents of two neighbourhoods in Port Harcourt (Old Township and Borokiri) and the sample as drawn from the selected neighbourhoods were administered a semi-structured questionnaire to elicit information on variables relating to the study. The Pearson Product-Moment Correlation Coefficient (PPMC) was used to correlate the effect of environmental quality of low-income housing on the independent variables, which include poor sewage services, adequacy of water supply, crowding index, housing design and drainage condition. The findings from the study indicated that in Old Township and Borokiri, adequate water supply showed a significant moderate positive relationship with housing design efficiency (r= 0.355) and wastewater efficiency (r = 0.382); Solid waste collection and disposal also showed a significant strong positive relationship with housing design efficiency (r = 0.696}, drainage efficiency (r=0.817) and energy efficiency (r=0.688); toilet system also showed a significant strong positive relationship with sewage efficiency (r =0.873} and energy efficiency (r= 0.608). A significant strong positive relationship between drainage facilities and housing design efficiency (r= 0.726), wastewater efficiency r=0.725) and drainage efficiency (r=0.621) was also observed. Findings revealed that the provision of adequate and efficient sewage services, adequacy of water supply, crowding index, housing design and efficient drainage is pertinent to improvement of environmental quality of low-income housing. The study concluded that sanitary and environmental quality parameters such as solid waste collection, basic water supply and quality of housing in the study area need improvement to achieve sustainable urban development. The study recommends that low-income residents should be enlightened and made aware of the benefits of sanitation and environmental quality in maintaining personal and environmental health. City authorities also need to devote more funds to the provision, improvement and maintenance of urban infrastructure that affect environmental quality in the study area.
Keywords: Environmental Quality, Sustainability, Low-income Housing, Urban Development

1.0 INTRODUCTION
Housing as a social and economic resource has a positive impact on the economy of any nation. Developed nations such as United Kingdom, parts of North America, Germany and some Asian countries such as Japan, Korea, and Singapore have well organised and effective housing system (Okoroafor, 2007). It is estimated that in Africa, 70 percent of the urban population live in informal settlement due to

the dense population of low-income earners who spend above 30 percent of their meagre income on housing (Finkel, 2005; Agbola *et al*, 2007;Denis, 2011).

In most settlements the percentage of population living in substandard houses are about 60-80 percent compared to 15-20 percent living in acceptable standards obtainable in developing countries. This is so because housing is all about affordability and many of those who live here do so on less than a dollar per day. This explains why housing problem is both qualitative and quantity strongly tied to the fact that finance is not available for the low-income earners (Okoroafor, 2007).

Federal Ministry of Lands, Housing and Urban Development (2012) characterized housing as the process of providing secure, comfortable, attractive, usable, affordable and recognizable shelter in a proper neighbourhood setting, supported by the continuous preservation of the built environment for the daily living activities of individuals within the community while representing their socio-economic, cultural aspirations and preferences.

This paper examines the environmental quality of low-income housing on sustainable urban development which can be characterized by housing congestion, poor drainage, poor toilet system, the indiscriminate discharge of liquid and solid wastes into the environment, inadequate social facilities and over-utilization of existing infrastructural facilities which will lead to a unsustainable environment (Femi, 2019). Sustainability implies an action that is be maintained over a period. It is the meeting of basic needs in order to sustain human life and about making responsible choices and decisions in an attempt to acknowledge the intricate connections between actions and effects with relation to the environment, economic growth and the growing society (Ede *et al*, 2011)

A well-planned housing system yields to environmental sustainability because the provision of adequate housing will incorporate the provision of improved indoor air quality, potable water, good sanitation, sewage and waste management, sustainable transport network and consequent reduction in environmental pollution. Overall, this will be a driver for sustainable national development; indicating that housing has significant effects on most of the domains of sustainable development (Amao, 2012; Ibem & Amole, 2010).

Within any given area, however, a series of minor environmental problems can combine to produce significant negative impacts. For example, the indiscriminate disposal of waste by several households will cumulatively lead to the pollution of that neighbourhood. The inappropriate practice associated with one household can over time lead to a major environmental problem with impacts on an entire community. The improper construction of drains on one house lot on a hillside, for instance may over time lead to the formation of a gully, which can cause the loss of large amounts of soil or inundation of properties located downhill (Olalekan, 2014). Therefore, as simple or insignificant as activities related to low-income housing may appear to be, they may contribute to significant environmental problems unless certain measures are taken.

Research has confirmed the profound inadequacy in the housing circumstances of Nigerians, in particular the low-income population (Olotuah & Aiyetan, 2006). The housing circumstances of low-income earners, who incidentally constitute the vast majority of the population, have not shown any significant improvement over the years. Research has shown that an estimated 2.3 million urban dwelling units in Nigeria are substandard, only 33 percent of houses considered physically sound, and 44 percent and 19 percent require minor and major repairs, respectively, to bring them to normative and structural quality. Sanitary facilities in most urban dwellings and public services especially; water and electricity supply are grossly inadequate. As asserted by Kamete (2006) urban facilities, especially housing has failed the growing demand of the poor. In line with the above issues, therefore, the purpose of this study is to examine the effect of environmental quality of low-income housing on sustainable urban development in Port Harcourt.

1.1 Study Objectives

This paper focuses on the inquiry to assess the effect of environmental quality of Low-income on sustainable urban development by identifying the factors of environmental quality of low-income housing then assessing the relationship between the effects of environmental quality of low-income housing and sustainable urban development.

2.0 METHODOLOGY

A research is a scientific investigation of events, situations or phenomena, which involve systematic collection, presentation, analysis and interpretation of collected data for solving problem. The data type uses *ex-post facto* research design because it does not manipulate the independent variable but describes the conditions that already exist as they are. The *ex-post facto* research design evaluates environmental quality of low-income housing and its impact on sustainable urban development in Port Harcourt with the aim of analysing the independent variables such as toilet systems, adequate water supply, waste disposal, drainage availability and the effect it has on sustainable urban development.

The study population include the inhabitants of the selected neighbourhoods of Port Harcourt (Old Township and Borokiri; see Figure 1) based on which a sample size of 399 was obtained as presented in Table 1. A randomised sampling procedure used in the selection of low-income houses in Old Township and Borokiri and in selecting individual households as respondents from each sampled building. This study adopted the use of a validated semi-structured questionnaire, which was employed for data collection from the sampled population of the study.

Table 1: Sampled Neighbourhoods, Projected Population and Sample Size

S/N	Neighbourhoods	Projected (2020) Population	Sample Size	Percentage (%)
1	Old Township	26946	96	24
2	Borokiri	85430	303	76
	Total	112,376	399	100

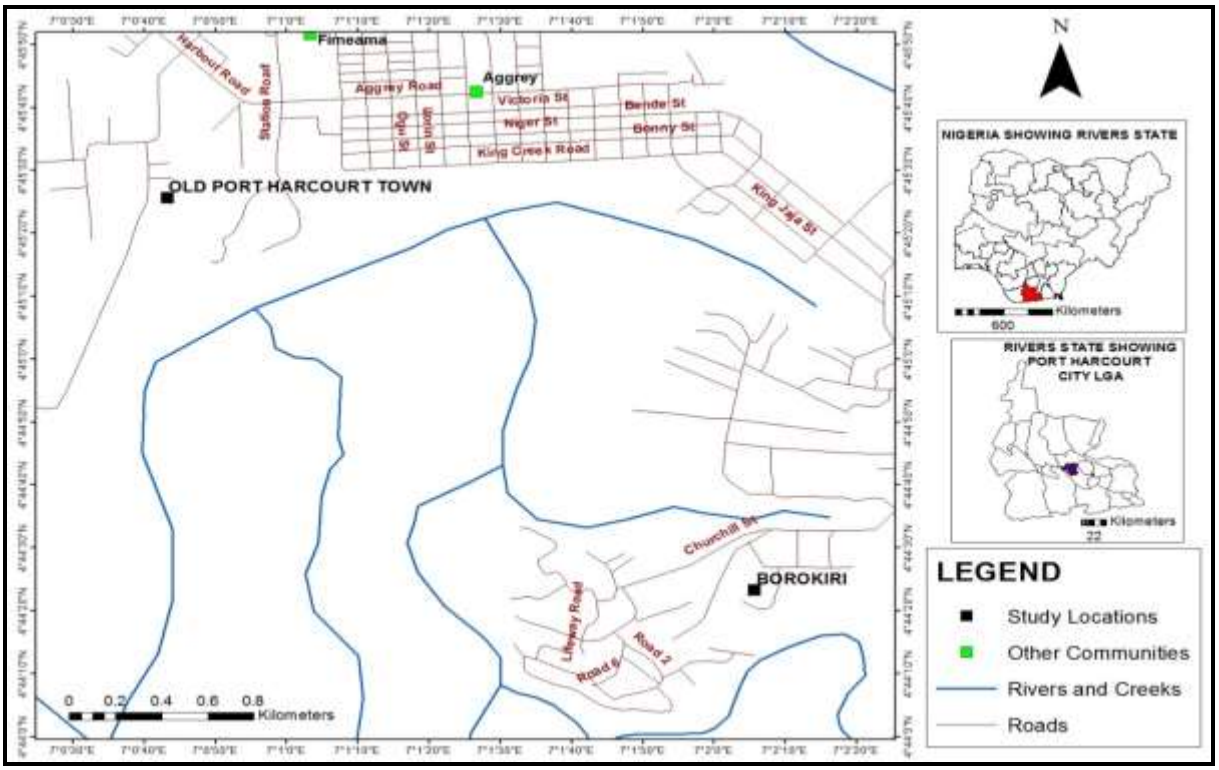

Figure 1: Old Port Harcourt Township and Borokiri Neighbourhoods

Pertinent variables of environmental quality of low-income housing identified include basic water supply, solid waste collection, wastewater systems, and drainage facilities while the variables of sustainable urban development include housing design efficiency, wastewater efficiency, drainage efficiency and energy efficiency. Correlations of these variables using Pearson Product Moment Correlation Coefficient were conducted.

3.0 RESULTS AND DISCUSSION

The deductions from this research encapsulated within the broad spectrum of the objective of the study to distil findings from both the literature review and research observations on the environmental quality of low-income housing and its effect on sustainable urban development in Old Township and Borokiri. All the data generated in the study were converted into graph as presented in Figures 2-7.

3.1 Adequate Household Water Supply

On household water supply in Old Port Harcourt Township 20% of respondents obtained water from their personal boreholes, 35% from hand-dug wells and 45% purchase water from public borehole. In Borokiri, 15% of the respondents get water from their personal boreholes, 38% from hand dug wells and 47% purchased water from public boreholes. The low income housing in Port Harcourt town and Borokiri have three major sources of domestic water supply from the use of privately owned boreholes to hand dug wells which are used by residents living at close proximity to it, then the public boreholes which sometimes may be far from their homes and they pay a price for it. These water sources mainly used for drinking and domestic use with over 60% of this water not treated which leads to contaminated water and in turn causes diseases such as cholera, diarrhoea, dysentery and typhoid.

Fadare & Olawuni (2008) asserted in line with accessibility to water supply and sanitation, Murray and Lopez (1996) noted that 5.3% of all death worldwide is attributed to poor water supply, sanitation and hygiene. In a study conducted by Jacobi et al (1998), in Sao Paulo, Brazil, it was reported that, 94.4% of the respondents were connected with public water system, and 59.8% reported that the supply was unsatisfactory in certain times of the year. In peripheral of Sao Paulo, (Capela Do Socorro), the author reported that 74.0% have problems with water supply and that the after effect of this relates to problems of household cleanings, and personal hygiene. When water supplies and sanitary conditions are inadequate, health problems are imminent according to Bateman et al (1998), in an epidemiological study of five African countries. The author asserted that the association between improved sanitation and health is strong or even stronger than the association between water supplies and health. He went further that health benefits may not associate with improved water supplies in areas where the overall level of sanitation is low; and that water supply should be as close as possible to the point of use, to maximize the health benefits.

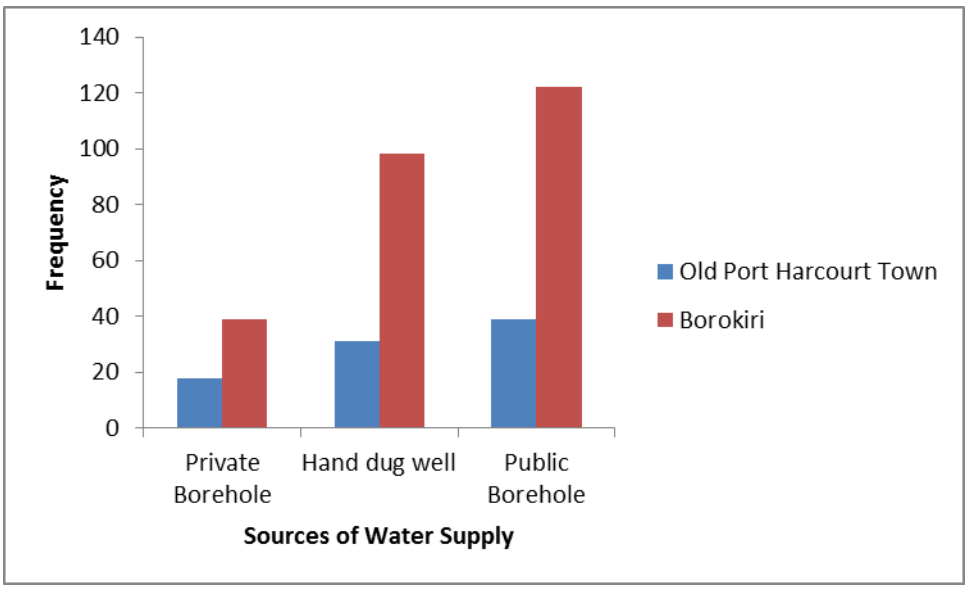

Figure 2: Sources of Domestic Water Supply to Households

3.2 Household Waste Disposal and Collection

The frequency at which households dispose their waste, 22% said they do so daily, 37% dispose twice a week, 41% dispose weekly and in Borokiri 37% of respondents dispose household refuse daily, 44% dispose twice a week and 29% dispose weekly.

The distribution of responses in Old Port Harcourt Township for frequency of solid waste evacuation by the government agency tasked with it was 64% weekly and 36% twice weekly. In Borokiri, 70% of the respondents reported weekly evacuation and 30% twice weekly.

From the responses given by the respondents, dispose dump refuse at collection points for the collection by Government contractors and subsequent disposal at final disposal sites, which is open dumping.

These respondents dispose daily, twice weekly and the rest weekly, but the collection of these wastes occurred twice weekly and weekly leaving daily wastes not evacuated for an interval of about two days or more. This practice leaves heaps of improperly disposed waste refuse that engender the breeding of rodents, vectors and emission of bad odors. Wokekoro and Inyang (2007) in her study observed that respondents in the low-income neighborhoods dispose their refuse at collection points for the collection by Government contractors and subsequent disposal at final disposal sites. The study revealed that the ratio of households which dump refuse indiscriminately are more in the informal low-income settlements like Bundu and Marine base than informal low-income settlements like Diobu. Most of the respondents affirm that the method of refuse collection and disposal in the city and in their neighborhoods is poor.

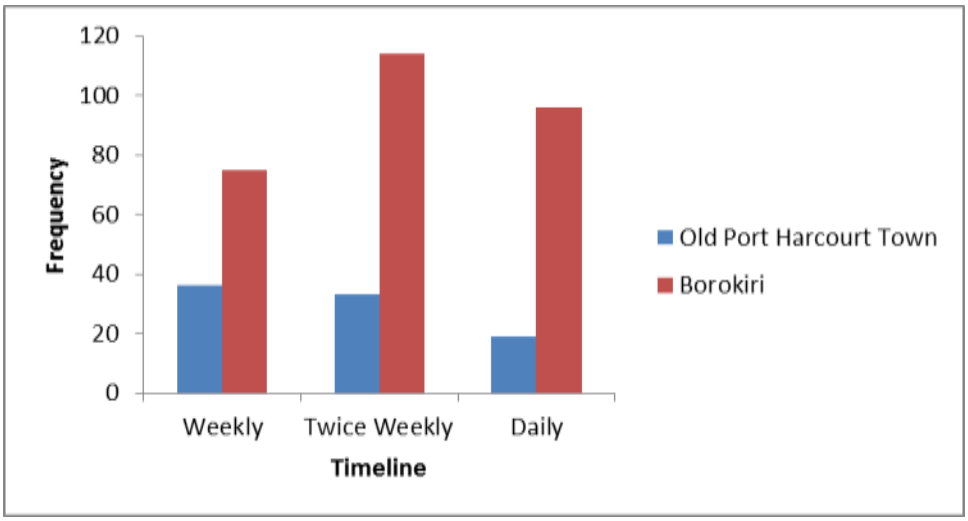

Figure 4: Frequency of Household Refuse Disposal by Respondents in the Study

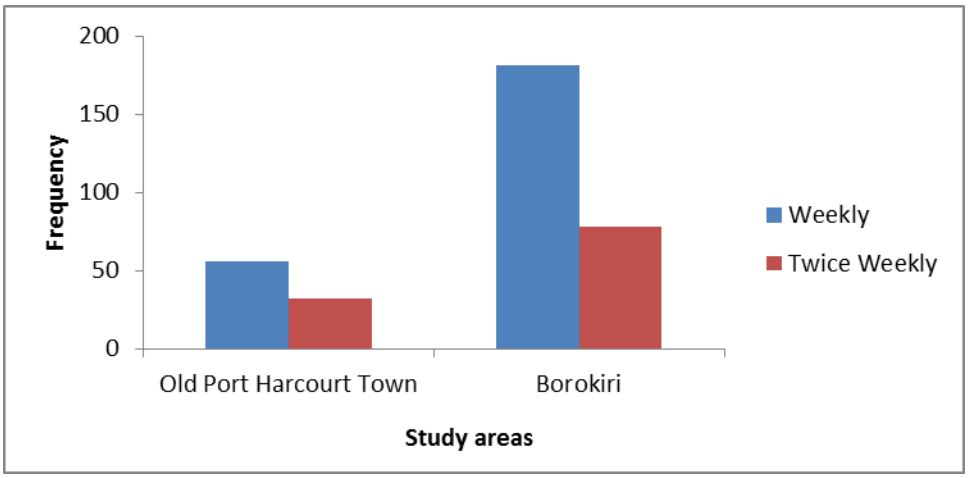

Figure 3: Frequency of Waste Collection

3.3 Toilet Systems

The commonest toilet system (44%) in Old Port Harcourt Township is the floating river toilet, 38% use pit latrine and 28% use water closet while in Borokiri 21% use floating river toilet 49% use pit latrine and 30% use water closet.

The respondents affirm that the disposal of human waste in their neighborhoods is poor. Human waste disposal into creeks is second most common toilet system used which is the major cause water pollution in these areas. The data gotten from the study areas also revealed over 30% disposal of human waste in pit latrine pollute the environment and can cause serious diseases such as cholera.

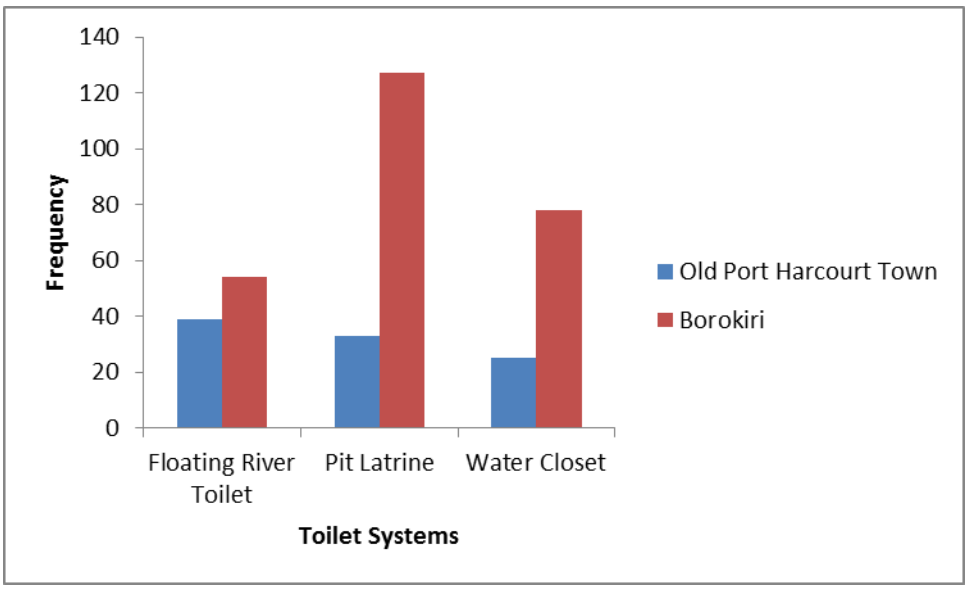

Figure 5: Types of Toilet Systems in the Study Areas

3.4 Availability of Drainage facilities

Drainage facilities in the Old Township was very poor because 77% responded to have no drainage around their homes and 23% reported to having well-structured drainage system around their home. In Borokiri 68% responded to having no drainage and 32% responded to having some form hand dug by the residents.

In both Old Port-Harcourt Township and Borokiri, respondents added that the drainages are mostly clogged with debris. Twenty eight percent clean the drainage weekly and 72% clean monthly, usually on sanitation days in Old Port Harcourt town. In Borokiri, 35% clean weekly and 65% clean monthly. The drainages available in the study are usually clogged and silted because drains are turned into dumping grounds for refuse that led to a very good breeding ground for mosquitoes. The outcome of this is human infestation with malarial parasites.

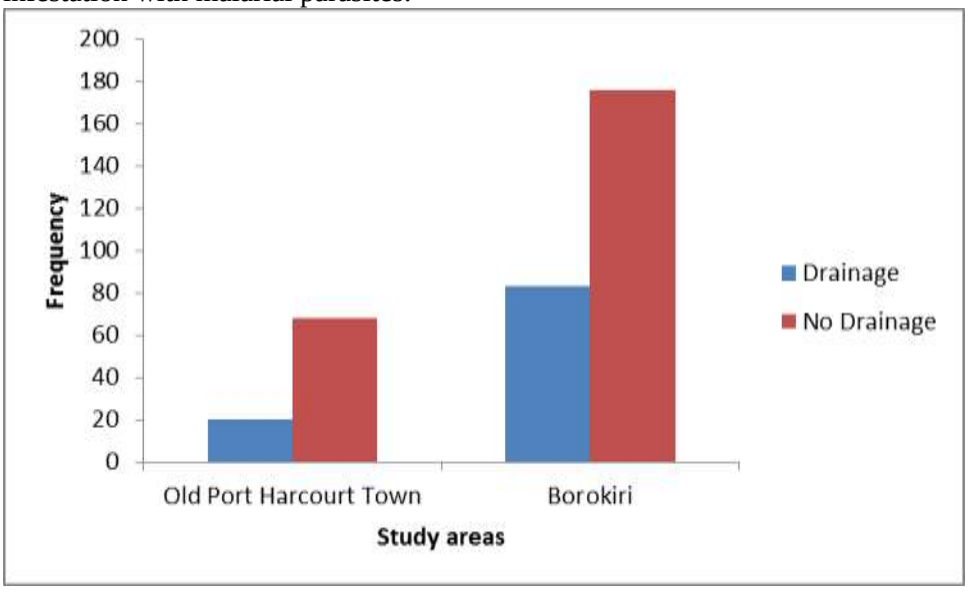

Figure 6: Availability of Storm Water and Sewage Drainage

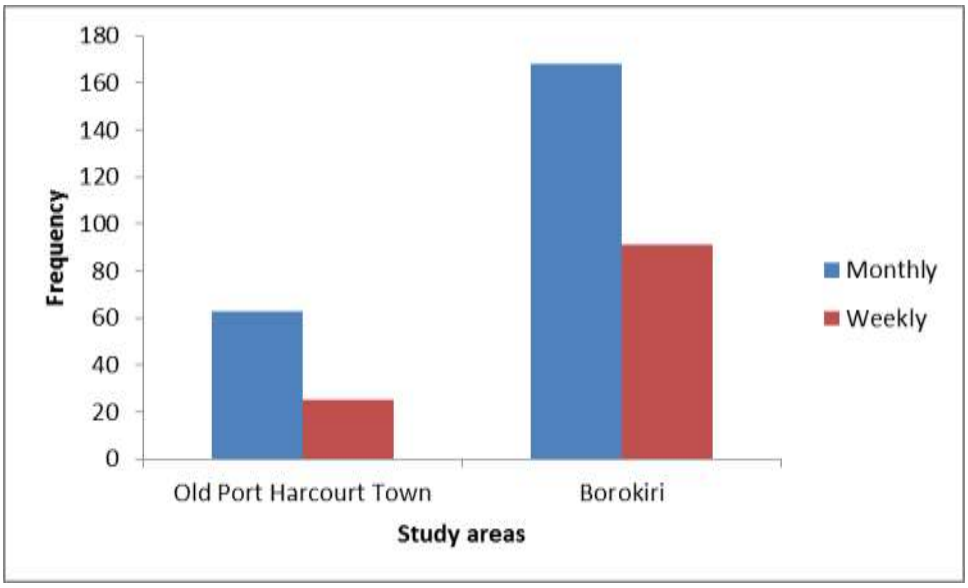

Figure 7: Frequency of cleaning of silted drainages

4.0 RESULTS AND DISCUSSION

Adequate water supply has a correlation coefficient (r) of 0.355 and 0.382 with housing design efficiency and wastewater efficiency in Old Township and Borokiri indicating a significant moderate positive relationship between the three variables. This shows that an increase in adequate water supply will lead to an increase in housing design and sewage efficiency in Old Township and Borokiri at a moderate rate while a decrease in adequate water supply will lead to a decrease in housing design efficiency and sewage efficiency in Old Township and Borokiri at a moderate rate. Adequate water supply also has a correlation coefficient (r) of 0.180 and 0.180 with drainage efficiency and energy efficiency indicating a significant weak positive relationship between these variables. This shows that an increase in adequate water supply will lead to an increase in drainage efficiency and energy efficiency at a lower rate in Old Township and Borokiri while a decrease in basic water supply will lead to a decrease in drainage efficiency and energy efficiency at a lower rate.

Solid waste collection and disposal has a correlation coefficient (r) of 0.696, 0.817 and 0.688 with housing design efficiency, drainage efficiency and energy efficiency in Old Township and Borokiri indicating a significant strong positive relationship between the four variables. This shows that efficient solid waste collection will enhance housing quality in the study area; Solid waste collection also had a correlation coefficient (r) of 0.410 with sewage efficiency in Old Township and Borokiri indicating a significant moderate positive relationship between the two variables. This shows that an increase in the solid waste collection will also cause an increase in the efficiency of wastewater systems in Old Township and Borokiri.

Toilet system has a correlation coefficient (r) of 0.873 and 0.608 with sewage efficiency and energy efficiency in Old Township and Borokiri indicating a significant strong positive relationship with the two variables. This shows that as the wastewater system increases, wastewater and energy efficiency also increases at a higher rate.

Drainage Facilities has a correlation coefficient (r) of 0.726, 0.725 and 0.621 with housing design efficiency, wastewater efficiency and drainage efficiency in Old Township and Borokiri indicating a significant strong positive relationship between the four variables. This shows that an increase in drainage facilities will lead to an increase in housing design efficiency, wastewater efficiency and drainage efficiency at a higher rate in Old Township and Borokiri while a decrease in drainage facilities will lead to a decline in wastewater efficiency and drainage efficiency in Old Township and Borokiri at a higher

rate. Drainage facilities also have a correlation coefficient (r) of 0.461 with energy efficiency in Old Township and Borokiri indicating a significant moderate positive relationship between the two variables. This shows that an increase in drainage facilities will also cause an increase in the efficiency of wastewater systems in Old Township and Borokiri at a moderate rate.

The table below shows the correlation results between variables of environmental quality of low-income housing and sustainable urban development.

Table 2: Correlation results among variables between effects of environmental quality of low-income housing and sustainable urban development

		1	2	3	4	5	6	7	8
1	Adequate Water Supply								
2	Solid Waste Collection	.309**							
3	Waste Water Systems	.460**	.191**						
4	Drainage Facilities	.706**	.697**	.460**					
5	Housing Design Efficiency	.355**	.696**	-.184**	.726**				
6	Waste Water Efficiency	.382**	.410**	.873**	.705**	.720**			
7	Drainage Efficiency	.180**	.817**	-0.03	.621**	.843**	.591**		
8	Energy Efficiency	.180**	.688**	.608**	.461**	.192**	.163**	.522**	

Note: N= 347, *p<.05, **p<.01
Source: Field Survey, 2020

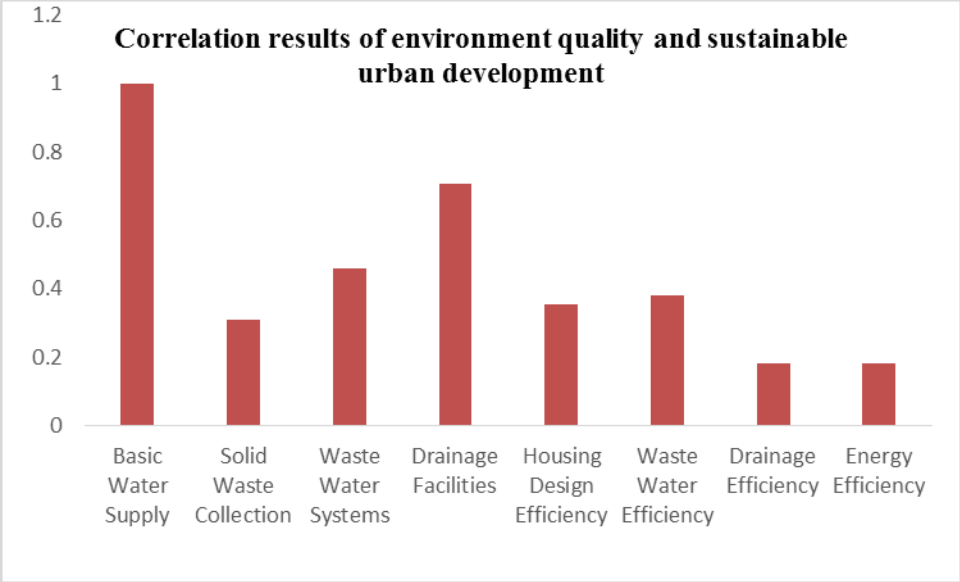

Table 3: T-test Results of Environmental Quality of Low Income Housing

Environmental Qualities		Mean					
Levene's Test for Equality of Variances (Equal variances not assumed)		X_1	X_2	X_1-X_2	P-value	T_{crit}	T_{calc}
F	22.874	27.88	17.42	10.46	0.000	1.658	27.772
Sig.	.000						
T	-27.772						
Df	115.085						
Sig. (2-tailed)	.000						

Level of Significance: 0.05
Results:
X1 = Borokiri
X2 = Old Township
Level of significance = 0.05
Degree of Freedom (d.f.) = 115
Critical values = 1.658
Calculated value = 27.772

From the above table, the Levene's test for equal variances not assumed is NOT rejected, since its p-value is less than 0.05, therefore subsequent interpretations will be based on Equal variances not assumed. The critical value of t obtained at d.f. 115 is given as 1.658. Since the p-value (= 0.000) is less than α (= 0.05), also calculated absolute t (= 27.772) is greater than the t-crit (= 1.658), we, therefore, reject the null hypothesis which states that there is no significant difference between the environmental qualities of low-income housing in the study areas.

5.0 CONCLUSION

It is acknowledged that the provision of adequate water supply is pertinent to the improvement of the environmental quality of low-income housing for sustainable urban development in the study area. Solid waste collection is a factor of environmental quality of low-income housing and can affect sustainable urban development. The sewage management systems were identified as one of the factors that determine the environmental quality of low-income housing and affects sustainable urban development in the study. Drainage facilities are also very essential in determining the environmental quality of low-income housing and can affect the sustainable urban development of Old Township and Borokiri if the themes of sustainable urban drainage systems are not implemented. However, these prevailing conditions will not be sustainable if something drastic and urgent is not done by key stakeholders through collaborative efforts of government agencies and departments at the local, state and national levels and the communities themselves. Finally, this study helps in supporting the government for the development of a decision support tool to help improve the decision-making process in implementing sustainability in housing projects for low-income earners in Old Township and Borokiri. Based on the findings, recommendations are hereby made to improve on the environmental qualities of existing, new and future housing for low-

income earners in the study area. Low-income residents need to be educated on the benefits of personal hygiene and environmental quality in maintaining good health.

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