Biophysical Environment Degradation and Housing Development in Enugu Urban

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Abstract

The essence of this study is to carry out an empirical analysis of biophysical environment degradation and housing development in Enugu Urban. The theoretical framework adopted in this study is the functionalist housing theory. The study adopted the survey method and data was collected from thirty (30) respondents distributed among three estates, namely, Fidelity Estate, Maryland Estate and Bethel Estate all in Enugu Urban, Enugu State Nigeria. Data for this study was analyzed with the ordinal logistic regression. This is justified on the fact that ordinal logistic regression is used to predict an ordinal dependent variable given one or more independent variables. The major findings of the study were that housing development in Enugu metropolis has a negative and significant impact on water quality and housing development in Enugu State has a negative and significant impact on soil quality. It is therefore the recommendation of this study that the housing authorities in Enugu Urban should institute measures to ensure that housing development does not compromise environmental quality, house owners, Estate developers and indeed all residents should be properly sensitized through environmental education on the dangers of abusing environmental standards.

Keywords: Biophysical, environment, degradation, housing development, Enugu urban

Introduction

In an ordinary parlance, a biophysical environment can be seen as a biotic and abiotic surrounding of an organism or population, and consequently includes the factors that have an influence in their survival, development, and evolution (Deng & Wilson, 2006). A biophysical environment can vary in scale from microscopic to global in extent. A conducive biophysical environment is necessary for land fertility, environmental equilibrium and other miscellaneous benefits. However, the rate of housing development and construction in many parts of Nigeria, Enugu state inclusive, calls for a concern.

However, there is an adverse relationship between housing construction and environmental sustainability. The two variables tend to move in an indirect proportional relationship. Whenever there is an increase in housing construction and development, the lower the level of environmental

sustainability (Vanclay, 2015). Housing is the second most essential human need after food. It is an integral part of human settlement that has a profound impact on the quality of life, health, welfare, productivity of man as well as economic development and environmental sustainability. This implies that housing has a multiplier effect on the human society and economic development. In spite of this essential nature of housing, a large proportion of the population in most developing countries does not have access to decent housing at affordable cost (Sengupta & Sharma, 2016).

Environmental effects of housing construction activities may vary from place to place, state to state, country to country. These major environmental impacts of housing construction projects includes; pollution, waste disposal, resource use and habitat destruction, desertification, soil erosion and material wastage etc. Housing construction activity such as use of resources like timber and non-fuel materials etc. leads to habitat destruction, loss of arable land, and loss of biodiversity etc. (Janjic, 2016).

The rate of public housing development in Enugu Urban is on a progressive path like other counterpart states. This is informed and sponsored by the need for shelter, welfare and economic gains that accrue from letting it out to prospective tenants and occupants (Attamah, 2016). However, the biophysical impacts and effect of such public housing development activities and housing development in the state is not receiving due attention and this is considered an environmental risk. Though is known that housing development creates jobs to skilled and unskilled labour, which includes architects, engineers, truck drivers, labourers, accountants, contractors, managers and business owners, just to name a few, one has to also know they have negative effect on the biophysical environment. But not everyone realizes that when we build, use and demolish houses, we disturb and erode soil, disrupt habitats, deplete natural resources, pollute air and water and use up land (Janjic, 2016). The construction industry has a significant irreversible impact on the environment across a broad spectrum of its activities during the off-site, on site and operational activities, which alter ecological integrity of the environment. This is because buildings are very large contributors to environmental deterioration.

In this paper, two variables were used to measure the biophysical environmental impact namely; water and soil quality. The paper aims at evaluating the reactions of these variables based on progressive housing development in Enugu Urban. In another way, the paper is focused on empirically investigating the effect of housing development on the biophysical environment measured with water and soil. The rate of housing development in Enugu Urban calls for an empirical study to estimate the reactions of the biophysical environment. Existing literature shows that there is paucity of studies on the relationship between housing development and biophysical environment sustainability in Enugu Urban. Related studies were not within the scope of this study. For instance, Iloeje et al (2013) carried out a study on housing deficit and environmental challenges in Enugu Urban and Ononugbo, Akpan and Osho (2010) investigated on an assessment of housing

needs for the low-income people of Enugu Metropolitan areas of Nigeria: Evidence from Statistical Housing Model Approach. A study that is quite close to the present study is the paper written by Emeka (2017) on environmental degradations, strategies and effective management practices in Enugu, Nigeria. The deviating point being that he did not analyze the effect of housing development on the environment, rather focused on causative factors like solid waste management, the menace of deforestation, and development of slums as well as water and air pollutions in the area. The essence of this paper is to ascertain the extent of biophysical reaction based on increased housing development in Enugu metropolis.

Objectives of the Study

The broad objective of this study is aimed at ascertaining biophysical environment and housing development in Enugu Urban. This necessitates the following specific objectives:

1. To ascertain the effect of housing development on the water quality in Enugu Urban.
2. To ascertain the effect of housing development on the soil quality in Enugu Urban.

Hypotheses of the Study

Ho: Housing development has no significant impact on water quality in Enugu State.
Ho: Housing development has no significant impact on soil quality in Enugu State.

Literature Review

Conceptual Issues

Biophysical Environment

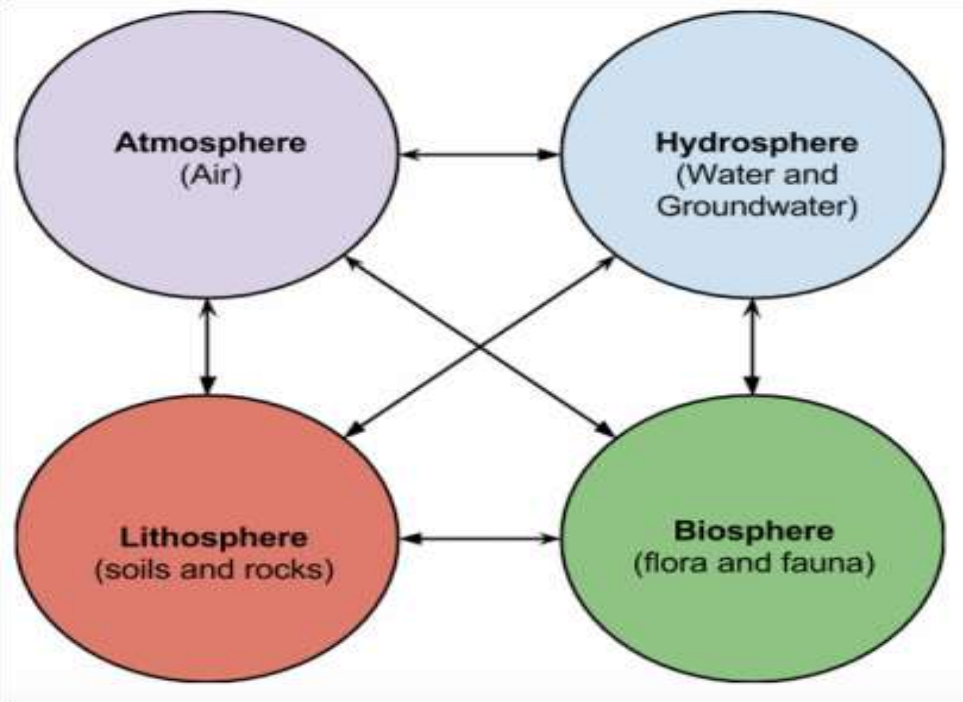
The biophysical environment includes living things (bio), such as plants and animals, and non-living things (physical), such as rocks, soils and water. The biophysical environment is made up of four parts: the atmosphere, hydrosphere, lithosphere and biosphere (Gordons, 2014). All ecosystems are a direct result of the biophysical elements of a given locality. The atmosphere, hydrosphere, lithosphere and biosphere all interact with each other at any given place.

The interactions of ecosystem are unique to any given place, but generalizations can be made. For example, the patterns of rainfall that occur at particular latitudes produce familiar biomes, such as arid lands or tropical rain forests at predictable places.

The Blue Mountains ecosystem is a clear example of unique interactions. The sandstone lithosphere been uplifted and interacted with the hydrosphere to weather the bed rock to produce stunning canyons and cliff faces. Moreover, the atmosphere creates a climate which accommodates a diverse range of flora and fauna in a ecological system (George, 2016).

The biophysical components are interactive by nature. This is demonstrated in figure 1 below:

Figure 1: Biophysical Interactions



Biophysical Sustainability

Through time and space, change is constant. The well-being of the present generation has implications for the future. The resent generation must suspend its conventional notions about change and its ability to learn. After all, there are no problems to resolve other than those we observe as manifestations of how we think and act. Policy makers make erroneous decisions again and again. Consequently, all living beings, including humans face devastation. This situation impacts not only the happiness of the present generation, but also future generations (Russ Beaton and Chris Maser, 2011). To secure the happiness and well-being of human social systems, it is essential to balance social and environmental sustainability.

Social-environmental sustainability demands that decision makers go beyond the immediate human valuation of a given resource to examine and disclose the fundamental issue of how its use will affect the long-term, biophysical sustainability of the ecosystem of which it is a component. One must also recognize and disclose the long-term, social-environmental issues that need to be dealt with concerning the method by which a resource is extracted. This is necessary because the overall

integrity of an ecosystem, its productive capacity, and the sustainability of its resources will determine the array of options passed forward to future generations (Maser, 2013).
To achieve ecological integrity, policy makers must understand biophysical principles as a condition of wise decision making. These principles form the underpinnings through which nature operates and the social limitation we must understand and accept, if we are to participate with nature in a sustainable fashion. Moreover, the policy makers must attend to these principles to ensure social environmental justice because the results of these decisions impact all generations, those present and those yet to come. This is particularly poignant in the face of an exploding human population, rapidly degrading ecosystems, and, dwindling per-capita resources (Nishan, 2016).

Housing

Housing is one of the three basic needs of mankind following closely after food, which is the most important factor for the physical survival of man. It is among the important measures of the state of an economy. Housing is considered to be one of the best indicators of a person's standard of living and place in the society (Jiboye, 2009). The concept transcends just providing a roof over one's head (Akinmoladun and Oduwaye, 2000). It forms the base upon which people could rebuild their lives following the disruptive impacts and trauma of homelessness (Smith, Albanese and Truder, 2014). Aside socio-economic and cultural relevance, housing engenders investment opportunities capable of promoting sustainable growth and development of an economy. Therefore, provision of adequate housing is an important measure of social welfare and economic development in any nation (Igbinoba, 2011).

It is obvious that access to adequate housing is an international human right. At diff erent times, governments of developed countries have played active roles in the housing sector for economic growth and development reasons. A housing sector may support poverty reduction and inclusive growth through its contribution to economic output, employment, generation of a demand for materials and related services, and improved standard of living of occupants (Doling, Vandenberg and Tolentino, 2013). However, uneven and unplanned urban growth usually place pressure on resources and limit the capacity to deliver housing and related infrastructural services (UN-Habitat, 2014).

Housing has been considered as a compendium of services such as neighborhood residential homes, shelters, parks, schools, amenities and a place of comfort and security that facilitate accessibility as well as proximity to jobs, work places and other social environment (Daramola, 2006). It is an area of production or economic resources capable of generating resources to keep its maintenance as well as growth. In other words, it is a proven economic growth driver.

Theoretical Framework

Functionalist Housing Theory

Functionality as a social paradigm emerged in American sociology in the 1940s and 1950s and emphasizes social harmony and its preservation. It focuses on the harmony of parts within a system, based on the principles of economy, simplicity, townscape adaptation and functionality. The functionalist theory was most widely used in urban geography, especially in determining the hierarchy of functions in cities (both apparent and underlying) (Fredrick, 2000). The functionalist theory of living was based on the statement that "the form always follows the function", which was particularly applied in architecture (Henry, 2008).

According to this premise, the function of the dwelling unit should be the basis of all other features (the size of the building, the floor area ratio within the building, etc.), and when the form and function of the dwelling unit were satisfied, housing satisfaction would be greater. I. Rogić (1990) criticized the functionalist approach to housing because of the idea of "mass housing" where, within the urban and housing reform, the aim was to increase housing satisfaction by constructing a larger number of residential units. He argued that flats in the "mass housing" concept were conceived only as objects that serve to satisfy the functions of nutrition, protection and sleep, while other functions are housed outside the dwelling unit. This concept is called "protective dwelling" by the author of the concept (Rogić, 1990). Thereby, the author does not refute the reforms that arise from the functionalist theory of housing, which refer to the improved level of public health and hygienisation of the city.

Empirical Studies

Adnan (2014) assessed the environmental impacts due to building construction projects activities in Gaza Strip and propose some suggestions in curbing down these adverse impacts. A total of 50 questionnaires were distributed to professionals working in the building construction industry. The environmental impacts are categorized into three safeguard subjects: ecosystems, natural resources and public impacts. The results of this study revealed that dust generation, noise pollution, operations with vegetation removal, and air pollution are the most significant environmental impacts of construction projects. The results also revealed that labors and those who are working in construction sector are the most slices of people exposing every day to health problems such as respiratory problems, liver cancer, hearing impairment, hypertension, annoyance, sleep disturbance, and other cardiovascular adverse effects. In addition, the public impact was found as the most important category that affects the environment in Gaza Strip. It is recommended to enhance the knowledge and awareness of construction participants with regard to environmental impacts of construction and enact strict laws to attempt curbing down the adverse impacts of construction such as enforcing institutions to conduct environmental impact assessment (EIA) in the early stage of the projects. The results of this study can help decision makers to identify major construction impacts

on environment and make environmentally friendly construction plans in the early stages of construction.

Mohamad, Linda and Richard (2009) carried out a research on life-cycle assessment and the environmental impact of buildings: a review. According to them, Life-Cycle Assessment (LCA) is one of various management tools for evaluating environmental concerns. Their paper reviewed LCA from a buildings perspective. It highlights the need for its use within the building sector, and the importance of LCA as a decision making support tool. It discussed LCA methodologies and applications within the building sector, reviewing some of the life-cycle studies applied to buildings or building materials and component combinations within the last fifteen years in Europe and the United States. It highlighted the problems of a lack of an internationally comparable and agreed data inventory and assessment methodology which hinder the application of LCA within the building industry. It identifies key areas for future research as (i) the whole process of construction, (ii) the relative weighting of different environmental impacts and (iii) applications in developing countries.

Herra (2009) carried out a research on impact of construction material on the environment in England. The study asserts that all around the globe the consumption of raw materials by the construction industries is accumulating day by day resulting with an depletion of natural resources, increasing the environmental impacts and CO2 emissions all over the surroundings. Today steel and concrete are widely used and are dominating construction materials in construction industry. These two construction materials are different products and have distinct production flow with significant impact on the environment. The amount of embodied energy and operational energy which is consumed in the process of production, recycling and reuse are becoming increasingly more important in the construction industries due to the potential shortage of natural resources in the nearby future and due to the inflation in the energy prices. The study with the use of descriptive statistics determined some of the problems of antagonistic environmental impacts due to the use of steel and concrete in the construction industries.

Mike (2015) carried out a study on reducing the environmental impact of construction by using renewable materials. The researcher posited that the relative importance of embodied energy and operational energy on the environmental impact of construction are examined in this article. It highlights the fact that the targets set by the Kyoto Protocol are primarily being met by the reduction of in-use energy, and that the implications of that are that the energy embodied in buildings will increase in significance from its current 17% level to 50% by 2050. The study described how the use of bio-based renewable materials can make a significant contribution to reducing not only the embodied energy of buildings by using these quest ration of CO2 through photosynthesis, but alsoin-use energy demand through passive environmental control. Case studies are presented showing ways in which this has been achieved.

Ijigah et al. (2013) conducted his research in Nigeria, and found that "dust generation" is in 11th position with RII= 0.752, and "destruction of vegetation" is ranked in the 1st position with RII= 0.841. Li X et.al (2010) conducted his research in USA, and found that "dust generation" is in the second position, and "Steel Use" is in the first position. This result indicated that peoples in USA believed that dust is a very important impact that affects the environment during building construction and development.

Li et al. (2010) and Zolfaghrian et al. (2012) conducted a research about environmental impact assessment of building construction and housing development, and categorized the environmental impact into three safeguard subjects: ecosystems, natural resources, and public impacts. Li et al. (2010) conducted his research in United States of America; his results demonstrated that public impacts form 27% of the total impacts. Ecosystem damage form 65% of the total impacts. Resource depletion form 8% of the total impacts. This means that developed countries like USA take the necessary measures to protect public health, and enacted strict laws to curb these effects down. Zolfaghrian et al. (2012) conducted an interview with an expert panel group in Malaysia, to determine the frequency and severity of the environmental impacts in the Malaysian construction industry. Their results demonstrated that among the three environmental categories, an ecosystem impact is ranked in the first position (67.5%) of the total impacts. Natural Resources Impact forms 21% of the total impacts. Public Impact consists of only 11.5%. This means that Malaysia has a high awareness regard to impacts of construction on public health. It takes the necessary measures to protect human health, and enacted strict laws to curb these effects down.

Methodology

Research Design

The research design used for this study was survey method because it studies both large and small population by selecting and studying samples chosen from the population.

Source and Method of Data Collection

Data for the study was collected through the distribution of well-structured questionnaires to selected residents. The questionnaire was distributed to thirty (30) respondents who are residents of three estates namely; Fidelity Estate, Maryland Estate and Bethel Estate. Ten respondents were gotten from each of the aforementioned estates.

Method of Data Analysis

Data for this study was analyzed with the ordinal logistic regression. This is justified on the fact that ordinal logistic regression is used to predict an ordinal dependent variable given one or more independent variables.

The logistic model/formular is specified thus:

$P_i = \Pr(Y = 1/\ X = x_i)$

The expansive model is specified thus:

$$Log\left(\frac{P_i}{1-P_i}\right) = \log it(P_i) = \beta_0 + \beta_1 x$$

Where:

Pi = Probability Coefficients

Log = Logarithmic Coefficients

Bo = The constant term/intercept

B1 = The structural parameter of the independent variables

X = The Independent Variable

Decision Rule (Probability Value)

Reject the null hypothesis (Ho) if the P-value < 0.05

Do not reject if otherwise.

The Statistical Package for Social Sciences (SPSS) will aid the data analysis.

3.4 Model Specification

The model for this study is given by:

$WQ = \beta_0 + \beta_1 HD + \mu$.....3.1

$SQ = \beta_0 + \beta_2 HD + \mu$.....3.2

Where:

WQ = Water Quality

SQ = Soil Quality

HD = Housing Development

B's = Parameters to be estimated

Data Analysis and Interpretation of Results

In the course of the study, 50 questionnaires were distributed to the respondents distributed among the three aforementioned estates. Information extracted from the questionnaire was analyzed with the one-sample t-statistics. This statistical technique revealed the effect of housing development on the selected biophysical elements (water & soil).

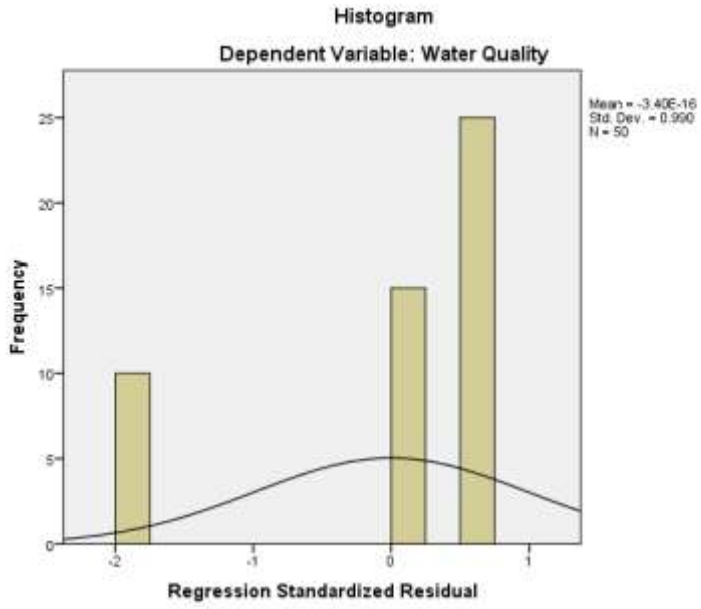
Results Presentations and Analysis

Table 1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.429	.164		8.706	.000
	Housing Development	-.286	.119	-.327	2.400	.020

a. Dependent Variable: Water Quality



From the regression output in table 1, one can clearly see that the numerical coefficient of the unstandardized parameter yielded a negative value at the magnitude of -0.286. This entails that there exists an inverse relationship between housing development and water quality in Enugu state. This also entails that an increase in housing construction and development results to a decrease in water quality by 0.286.

The probability value (Sig.) yielded 0.020 which is obviously less than 0.05. This entails that from hypothesis one, we conclude that housing development has significant and negative impact on water quality in Enugu Urban.

Table 2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.124	.208		5.396	.000
	Housing Development	-.305	.151	.280	2.017	.049

a. Dependent Variable: Soil Quality

From the regression output in table 2, one can clearly see that the numerical coefficient of the unstandardized parameter yielded a negative value at the magnitude of -0.305. This entails that there exists an inverse relationship between housing development and soil quality in Enugu Urban. This also entails that an increase in housing construction and development results to a decrease in soil quality by 0.305

The probability value (Sig.) yielded 0.049 which is obviously less than 0.05. This entails that from hypothesis two, we conclude that housing development has significant and negative impact on soil quality in Enugu Urban.

Summary, Conclusion and Recommendations

This study has been able to evaluate the effect of housing development on the biophysical environment of Enugu state. In the course of the study, two elements were used to measure biophysical environment in this study, namely; water and soil quality. The method of data analysis used was the linear regression with the application of Ordinary Least Squares (OLS technique. The major findings of the study were that:

- Housing development in Enugu Urban has a negative and significant impact on water quality.
- Housing development in Enugu Urban has a negative and significant impact on soil quality.

Based on the findings conclusion, the following recommendations were suggested:

- The housing authorities in Enugu Urban should institute measures to ensure that housing development does not compromise environmental quality.
- House owners and indeed all residents should be properly sensitized through environmental education on the dangers of abusing environmental standards.
- Strict enforcement of building and environmental bye-laws to punish those landlords who fails to provide the basic housing development standards.

- For each tree cut down, either during construction or for use of building material six more should be replanted.
- Training and retraining of both professionals and nonprofessionals in the construction industry on the need to protect, themselves against the ills, of the construction site.
- Making sure to have a strong waste management plan, to monitor and improve the management and disposal of site waste, making sure all waste is correctly dealt with to stop it from spreading.

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