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Developing a Model for the Measurement of Residential Environmental Quality of Enugu, Nigeria

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ABSTRACT
Environmental degradation has bedeviled most urban areas in Nigeria. Inspite of the efforts being made by both state and federal governments to effectively tackle the problem, there has been no remarkable solution as it is not often very easy to measure the environmental quality of many urban areas in the country. This paper, therefore, develops a model for the measurement of environmental quality in Enugu metropolis. Multiple regression model was used to establish a relationship between residential housing investments and environmental quality of Enugu metropolis. Housing investments (public and private investments) were used as 'X1' and 'X2' (independent) variables while the environmental quality of the area was the 'Y' (dependent) variable. In the result, the coefficient of determination showed that adjusted r^2 = 915 indicating that 91.5% variation in the environmental quality can be predicted from public and private housing investments. Thus, the regression equation; Y = a + b1 pub. Invt. + b2 priv. invt. + E. Hence, Environmental quality = 24.25 - 1.35 pub. invt.-2.25 priv. invt. + 7.02. Considering the current trend in upholding sustainability in the environment, this model could be used to measure the environmental quality of Enugu Metropolis.
Key words; Model, Environmental, Quality, Enugu, Nigeria.

Introduction

In recent time, environmental degradation has vigorously manifested, particularly in urban environments of Nigeria. Rapid urban population growth among other factors has been identified as compounding urban environmental management. Makinwa (1981), observed that the rate of rural urban migration has increased over the years inspite of urban unemployment in Nigeria. Lack of essential public facilities and social amenities in the rural areas as well as the social change which took place after the establishment of the colonial rule in Nigeria has pushed many people out from the rural parts of the country. Furthermore, with the crude oil boom in 1970s, investments were attracted primarily to urban areas. Hence many rural dwellers mostly young men and women migrated from rural to urban areas in search of white collar jobs.

The above scenario and other factors, directly or indirectly defaced the environmental quality structure of urban areas in the country. It has therefore, become imperative that the environmental quality status of any given urban environment is known, so as to ascertain the appropriate measures to take to step-up or up-hold the quality of that environment. Thus, this study, developed a model for the measurement of the environmental quality of any given environment.

Literature Review

Cendrero and Fischer (1999), in Florida, worked on the procedures for assessing the environmental quality of coastal areas for planning and management based on the identification of certain characteristics. This, they did using certain indicators including number of storms per year, and thereby proposing numerical indices of the indicators. The indices could be used for monitoring environmental change with time. The method can help to determine whether existing management and policy trends move away or towards sustainability. Again, it can facilitate the integration of scientific assessment into the process of coastal planning and management through the application of indices which give the summary of environmental characteristics in terms that should be significant to planners and managers. However, because of the peculiarities of coastal areas, it could be seen as an irony of circumstance for the procedure for assessing environmental quality in a coastal area to be generalized to every other environment.

Kain and Quigley (1970) carried out a study on measurement of residential quality in the city of St. Louis in United States of America. Evaluations of the quality of sample dwelling units, structures and blocks used in the study were obtained from three separate surveys of approximately 1,500 households and dwelling units in the city. In the first survey, interviewers were instructed to rate the quality of particular aspects if each dwelling units e.g the wall, on a scale ranging between 1 (excellent Condition) and 5 (requires replacement). A second survey conducted by city building inspectors provided quality ratings for specific aspects of the exterior of each sample structure and parcel and of those either side of the sample dwelling. Building inspectors also rated aspects of the quality of block face (both sides of the street) on which the sample dwelling units were located, recorded the presence of specific adverse environmental influences such as noise, smoke, heavy traffic and noxious odour, and estimated the extent of non residential activity on the sample blocks. These surveys

provided 39 variables indicating the physical or visual quality of the bundle of residential services including seven measures of the quality of dwelling units (e.g condition of floors, level of house keeping etc), seven measures of the quality of the structures and parcel (e.g Condition of drives and walks etc), eight measures of the quality of adjacent, properties (e.g condition of structures etc) and seventeen variables pertaining to the residential quality of specific aspects of the block face (e.g percentage of non- residential use etc). Detailed quality judgment about many components of the bundle of residential services were obtained on the premise that individual interviewers and building inspectors would provide more consistent and precise evaluations of narrowly defined individual components than they could about broader aggregates. A second premise was that subsequent statistical aggregation of many separate judgments would provide more consistent and meaningful quality measures than the subjective aggregation implicit in obtaining overall quality judgment from individual evaluator. Two different methods of aggregations were used in constructing the composite quality variables, with generally consistent results. The first set of composite quality indexes were simple, un-weighted means of the individual quality measurements for the dwelling units, the structure, the adjacent structures and the block face. The second set used in the regressions were derived from the original 39 variables by factor analysis. The result produced a five factor solution, which accounted for 60 percent of the variance among the 39 original variables which seemed to provide the most meaningful description of the quality dimensions of the bundles of residential services. Each of the five factors appeared to represent a separable and intuitively meaningful quality dimensions of the bundles. Although this procedure reduced the danger of interviewers' inconsistent and arbitrary aggregation, it created the corollary problem of how to reduce the 39 separate quality measures to a more manageable number.

Also in United States of America Brasington (2005) estimated the relationship between housing prince and environmental disamenities using spatial statistics to uphold the view that nearby point source pollutants depress house price. Appling the statistics, six spatial Hedonic regressions for Akron, Cincinnati, Cleveland, Columbus, Dayton and Toledo were determined. The highlight of the results showed that the implicit prices of environmental quality and related characteristics from the house price hedonics the estimate of a demand curve for environmental quality. It was also found that there was significant evidence in spatial effects in both the hedonic and demand estimations, and that environmental quality and house sizes are substitutes.

Perz (2011) studying the environmental quality of Brazilian Amazon, emphasized that deforestation is not the only issue of importance concurring changes in environmental quality of the Amazon. Three dimensions of urban environmental quality were considered. Census data and health services statistics were used. The study compared enchanters of environmental quality in urban population of Amazon in 1980 and 1991 quantitatively. Thirty three environmental quality indicators were used. The results indicated that environmental quality in the region deteriorated during the 1980s as the production of and exposure to environmental hazards rose while resources to ward off hazards eroded, and that environmental quality was particularly poor in more rapidly growth urban centres. Consequently, this stands as a challenge for sustainable development in the Amazon.

Using Europe and America as case studies, Cendrero, Lopez et al (2003) worked on the procedure for sustainability assessment in Coastal areas, based on a series of indicator and indices that reflect environmental quality. Three dimensions of environmental quality (functions, interaction and components) were taken into consideration. The procedure was developed within the ELANEM Euro- Latin American project. The procedure offered the possibility of expressing environmental quality of the coastal areas in numerical form through the use of indices based on clear and replicable method, using indicators that can be measured or objectively determined. This method could provide a useful tool for monitoring environmental quality, thus helping to assess sustainability of existing policies and practices.

Bernaver and Konbi (2004) in their study on the effect of various political variables on environmental quality, took into account the effects of economic variables. Air pollution (concentration of sulfur dioxide) was used as the dependent variable. Annual observations for the year 1971-1996 from 291 observation sites located in 107 major cities in 42 countries (2,555 observations) constituted the data for sulfur dioxide concentration. Combining the environmental, economic, political and site specific components a statistical model was obtained. Through regression of sulfur dioxide concentrations on the explanatory variables, they obtained their results. Emerging from the result, there was indication that higher income, higher intensity of economic activity and greater trade openness contribute to lower pollution levels. The study could be useful for environmental quality monitoring. However, being an issue specific in nature, it cannot be generalized to other forms of environmental quality.

Assessing the inequality in the spatial distribution of accessibility and environmental quality in Paris metropolitan region, Palma et al (2007) asserted that local amenities are generally capitalized into housing market. Data from IAURGP GIS data base and metropolitan computations were used. The empirical analysis of the study showed that considerable inequality existed in the spatial distribution of the local amenities and social indicators. Spatial representation and Lorenz curves were used to examine the degree of inequality in these amenities. These provided evidence that some amenities were much more inequitably distributed than others.

The researchers therefore obtained new insight into how households in the Paris region trade off amenities against each other and against housing cost by estimating models at both a commune and at a grid cell level. Hence, they found that residential location choice model filled the data moderately better at the smaller scale of the grids cell compared to the commune. Thus G.I.S/EMIS could be seen to be invaluable for modern environmental studies in most counties of the world.

Majunder, Hossain and Islam, (2007) in an interesting environmental quality mapping study of Chittagong metropolis in Bangladesh, endeavoured to analyse both factual statues and perceptual pattern of the environmental quality of Chittagong Metropolitan City. The factual data were collected from various sources while the perceptual data were based on questionnaire survey of opinions of 492 respondents at the household level by City ward. The City's 40 wards were surveyed in this study using ranks of the wards by environmental groups. Thus, the study's numerous variables were classified into three: physical environment, neighbourhood environment and social environment. To determine the limit of satisfaction and dissatisfaction of the various environmental variables by respondents, satisfaction index developed by Hall, Yen and Tan was applied. It was tested against three levels of household income - high., medium and low income groups-using Chi-Square. The study presented the crying need to address urban environmental quality resulting from high rate of urbanization and urban population in Chittagong Metropolitan City. They concluded that community people should be mobilized in such effort because people's participation is very much fruitful in improving their environmental situation.

In Turkey, Alkay (2009) carried out a study on the relationship between environmental quality level and housing sale prices in Istanbul metropolitan area. The study was carried out in two stages. In the first stage the environmental quality index was measured, using principal component analysis, after standardizing the different units of measurements with similar indicators. Relationship between the environmental quality index and housing sale prices were explored in the second stage. Correlation coefficient and square goodness of fit were used. The result indicated that the weights of dwelling indicators and satisfaction from housing environmental indicators were positive while the economic, social and accessibility indicators were negative for the casual factor that explained the environmental quality at district level in the metropolitan area. The study therefore concluded that the increasing environmental quality levels depend on the increasing quality of dwelling characteristics and satisfaction from the housing environment. The result is useful in that it can show the overview of the environmental quality index at the district level, used by both public and private decision makers in improving the city. However, the study lacked time series data.

Besides, some studies have also been carried out in Africa as they concern the environmental quality of the area.

Alem and Martinson (2011) investigated the importance of environmental quality to the poor and what the policy makers know about it in Addis Ababa, Ethiopia. The citizens and policy makers were asked to rank the areas that they think government should focus on. The ranking areas were;

(a) Better health services, education and housing
(b) Creating environmental opportunity
(c) Controlling price rise
(d) Improved solid waste disposal
(e) Improved liquid waste disposal

In their finding, although standard determinants of subjective well being in western countries seemed to explain happiness in Addis Ababa, yet environmental quality equally played a very prominent role. Averagely, the policy makers had more long-term perspective by focusing on health, education and housing. The citizen on their part focused more on short-term issues such as controlling price rise. Hence, the government of the country went as far as introducing a strict control over prices of basic commodities, adopting the views of the citizens in this regard.

In Nigeria, different people have equally worked on environmental quality as it affects different cities or towns.

Olorunfemi (2009) studied the willingness to pay for improved environmental quality among the residents living in close proximity to two landfills in Olushoshun and Abule Egba, all in Lagos metropolis. The main instrument used in the collection of primary data was structured questionnaire. In the survey, a contingent valuation method was used, which solicited the residents preferences through survey technique to state their willingness to pay for the benefits gained from an improvement in environmental quality (an improvement in the quality of Landfill practices). From the results, there was an indication that the presence of the landfills and the associated environmental impact was an important factor contributing to respondent's willingness to pay for environmental improvement in their neighbourhood.

Examining the housing improvement of core residential environmental quality of Ogbomosho town, Afon (1998) made use of twenty variables and identified ten environmental quality indicators. Correlation matrix

was compared to determine the relationship existing between pairs of the variables. Correlation of the ten proved positive. Expressing the importance of the study, Afon advocated that it was no use for planners to impose their ideas on the public because people are better planned for when they have input into policy and programmes that will affect their present and / or future.

Ekurekong and Jacobs (1998) attempt to shed some light on compliance that ensure high attachment of environmental quality in housing estate in Uyo, Akwa-Ibom State. The study revealed that the housing estate by all indicators was deficient in facilities and service provision. The study also showed that more than 70% of the total area of the estate had been used for residential development, leaving less than 10% for the provision of facilities and services. These services were completely lacking in the estate. The analysis showed that the existing facilities were undoubtedly inadequate to support the huge population in the estate. An environmental quality unit was recommended to be established, to monitor and control quality of the environment in the estate.

Ede et al (2007) determined housing and neighbourhood quality for Yenegoa, Bayelsa State of Nigeria. The study sampled five neighbourhoods in the city to examine the problem, using questionnaires and physical observation as instruments. They looked at some of the variables that determine urban housing and neighbourhood quality as they relate to Yenegoa. The analysis made use of multiple Linear Regressions. The dependent variable (y) in the study was a composite value based on location. The statistical package for social sciences (SPSS) was used to explain the variations in the dependent variable by the independent variables. The results showed that sanitary services among other independent variables have the greatest significance level (.99 confidence levels). The coefficient of determination was 0.1, and it was significant at 0.00 levels. Other independent variables of significance that could be taken serious included modern toilet, good drainage and open space. There was an indication that housing developers in Yenegoa did not comply with the existing regulatory measures to improve the housing and environmental quality. This, indeed, creates a gap between the present conditions and the target of various policy instruments for regulating the neighbourhood environmental quality in Nigeria. In order to address the situation, it was recommended that existing regulatory measures such as urban and regional laws, the National Housing Policy, the Urban Development Policy and the State sanitation Edict be vigorously enforced by the government. Although the study was empirically conducted, the independent variables shown were more of housing than environmental. In other words, it contained a limited number of environmental quality variables.

Others include, Olanrewaju and Fadairo (2003) who emphasized poor state of streets as a problem which does not give room for efficient evacuation of solid wastes. Okeke (2002) noted that the extensive use of temporary structures in the high density neighbourhoods of Nigerian urban centres has constituted the fore runner of squatter settlement development in these areas. Emodi (2013) pointed out that rapid population growth among other factors have compounded urban environmental management, thereby negatively impacting surrounding environment. Umeakuka and Mba (1999) observed that blockage of storm water drainage paths in Onitsha with solid wastes which in turn induced flooding can not enhance the quality of the area. In 2005 Nwafor carried out a study on the recycling and re-use of urban solid waste in Enugu (Nwafor 2008).

Considering the factors that could affect housing investments Richmond (1985) observed that the investor will be primarily concerned with the yield that will compare with the ideal investment while Millington (1982), noted that national affaires are very important in influencing the mood of investors and that the state of the national economy is very vital.

Muoghalu, (1996) observed that Nigeria government's major concern in colonial era was the provision of housing for the officials. As the colonial masters left, Nigerian building society was fortified with an initial sum of N2. 25 million and charged to provide loans at reasonable interest level to Nigerians. However, Okunola (1996) noted that going by public housing effort, the masses of the urban population would have been living in the streets, and that the gap has been narrowed by the private sector. But private housing investment consisted of a lot of individual units built mainly in areas of large scale development. This has meant a significant shift in housing design, form and standard to a reduction in the number of housing units by 25% and which priced the low income out of available housing units (Okpala 1982, Muoghalu, 1996).

Although various authors have discussed or carried out researches on environmental quality, the review indicates some research gaps in this area of study. Environmental quality studies have so far primarily concentrated on the effects of economic and social demographic variables on environmental quality as observed by Bernauer and Loubi (2004). Besides, the available studies on measuring environmental quality focused mainly on peculiar areas as in the case of Cendrero and Fischer (1999). Again, a good number of the studies were on an aspect of environmental quality especially pollution such as in Olorunfemi (2009). Furthermore, public perception based studies were very common as exemplified in Afon (1998). It is therefore essential that a study of detailed environmental quality indicators is timely in Nigeria. This will aid in the measuring and ascertaining the environmental quality of an area, especially now that Nigeria and the rest of the world are

gearing towards sustainable environment, which invariably will take centre stage in addressing the issue of sustainable development.

The study Area

Enugu metropolis, the study area is located between latitudes $6^0$27'N and $7^0$28N and longitudes $7^0$30E and $8^0$19E. The urban land area is roughly 72.8 square Kilometers with the rural environs covering an additional area of about 200 square metres. It comprises three local government areas namely, Enugu North, Enugu East and Enugu South. Enugu metropolis is in Enugu State, located in the eastern part of Nigeria and embedded in the Guinea savanna belt, which is the broadest vegetation belt in Nigeria.

The metropolis which lies on an altitude of 232.6 metres above sea level exists natural domes in the South and undulating plains forming the foothills of Udi escarpment in the North. The population has been on the increase within the metropolis in the last few decades as a result of rapid urbanization and subsequent influx of people. In 1953 the population was 63,000. This rose to 482, 977 in 1991 and by 2006, the population was put at 7,22,664 (NPC, 2006).

Enugu started as a photo-urban settlement near the mines, following the discovery of coal in the Udi hills around 1909. 1va valley and Ogbete areas which were the first areas to develop functioned primarily as coal miners residences. With the discovery of deep sea harbor in port-Harcourt, construction of Enugu-Port Harcourt rail line commenced in Enugu in 1914. The first freight of coal was transported from Enugu to port-Harcourt in 1916. In 1917, Enugu, attained, township status and was then referred to as Enugu Ngwo. As a result of its rapid expansion towards areas owned by mixed indigenous communities rather than towards Ngwo highlands, it was renamed Enugu in 1928. By 1939 Enugu has become the headquarters of the then Southern province. It became a regional capital and the important administrative centre in the then Eastern Region with the creation of the three regions in Nigeria in 1961. Presently, it is the capital of Enugu state of Nigeria.

The annual rainfall in the metropolis is 1247.8mm and the rainfall is mostly during the months of April through October, having July as the peak period. The annual temperature of Enugu is about 30.8^0C and the variation within the season is normally less than 10^0C. The relative humidity fluctuates between 40 and 80 percent. The prevailing winds are the local monsoons; the North East Trade wind and the South West Trade wind. The North East Trade wind blows from across Sahara desert, with dry and dusty air over the area, hence resulting in dry season characterized by dusty harmattan weather. This season usually lasts from November to March. The South West trade wind blows from across the Atlantic ocean, brining about the raining season.

Methodology

In developing the model, interaction between environmental quality and housing investments was established. Environmental quality variables constituted the dependent variable while housing investment variables made up the independent variables. 21 environmental quality variables were used in the study, made up of 11 dwelling unit quality variables, 5 parcel quality variables and 5 basic residential quality variables. Housing investment variables were public and private housing investments. The mean of housing investment in each neignbourhood and each density area was determined and used.

Survey design was adopted. The metropolis was classified into 30 neighbourhoods, stratified into high, medium and low density areas. From these areas samples were selected randomly.

Primary data were mainly collected using questionnaires. Direct contact method of reaching the respondents was used. Closed form was mainly used in which choices of possible answers to open questions were provided. One thousand, four hundred and forty copies of the questionnaires were used in the analysis. Besides field tests were carried out to determine the air quality as well as the noise level of the areas.

Factor Analysis (Principal Component Analysis) was first used in the analysis of the data to reduce the various environmental quality factors. Varimax rotation was introduced to get the aggregate factor score as the singular "Y" variable. Then multiple linear regression was used to establish the relationship between environmental quality of the study area and housing investments (public and private investments) in the area. Environmental quality variables formed the "Y" variable while public and private housing investments made up the "X1" and "X2" variables respectively.

Hypothesis was used to test the relationship between the environmental quality variables and housing investment variables. The hypothesis was tested at 0.05 level of significance. From the relationship, a model was developed that could be used to measure the environmental quality of the study area, using the multiple regression equation.

Data Presentation and Analysis

The environmental quality variables used in the study include, the eleven dwelling unit variable (condition of floor condition of wall, condition of window, condition of ceiling, condition of roof, condition of lighting, structural condition, landscaping, nuisance, poor condition, neighbourhood problem. The five parcel

quality variables (condition of drives, fair condition of units, sanitary condition, drainage, noise level) and five basic residential quality variable (crowdedness, good condition of units, air quality, waste disposal and source of domestic water supply). Factor analysis was initially used and varimax rotation further applied to reduce the environmental quality factors.

Table 1: Varimax Rotated Component Matrix of Environmental Quality Variables.

	Component		
	1.	2	3
Floor	.673	.435	.486
Wall	.808	-.427	-.185
Window	.768	.437	.364
Ceiling	.789	.295	-.435
Roof	758	.249	--435
Lighting	.867	.240	-.317
Street condition	.835	.286	-.198
Landscape	.709	.249	-.310
Nuisance	.655	-.460	-.199
Drives condition	.574	-.660	-.952
Crowdedness	.176	.108	-.808
Poor condition	-.659	-.463	-.455
Fair condition	.216	-.786	.100
Good condition	.591	.184	.653
Sanitary condition	-.281	-.817	.106
Drainage	.494	.687	.178
Neighbourhood problem	.727	-.438	-.291
Air quality	.336	.265	.512
Noise quality	.339	-.623	.504
Waste disposal	.250	.491	.700
Dom water	.375	.483	.593

Extraction: principal component analysis
Rotation method: Varimax with Kaiser normalization

Table 1: above shows the rotated component of the environmental quality variables. After constant rotation, the result eventually turned out 3 factors. Factor 1 has an eigen value of 13.889, factor 2. 1.434 and factor 3 1.040

Factor 1 is significantly located on 11 variables stressing primarily the variables of the environment which hinge squarely on the dwelling unit component. Hence, the underlying factor identified could be regarded as the dwelling unit impact on the environmental quality of the study area.

Factor 2 has significant loading on 5 variables which constitute the most pronounced and conspicuous imprints on the adjacent structures and the parcel. This entails the extents to which quality of the units and surrounding within the same vicinity ar-e affected. The common focus within these variables is that they hinge on the parcels of the area. Consequently; the underlying factor could be identified as the parcel environmental quality.

Factor 3 is loaded significantly on 5 variables, the index appearing to measure the overall quality of the exterior physical environment. For this reason, it is referred to as Basic Residential Quality.

Meanwhile, the eigen value of each factor was used to multiply the individual factor score. They were eventually combined to get the aggregate factor score as the “Y” variable.

For housing investment variables, in both public and private housing investments, the costs of housing were determined in the neighbourhoods. The mean value of investments in each of the nieghbourhoods was found. The mean values of public investments depicts “x1” variable while that of private investments is “x2” variable. To establish a relationship between the environmental quality variable and housing investment variables, SPSS version 13 was then used to analyse the data.

The SPSS out put: regression outputs are,

Model Summary

Model	R	R-square	Adjusted R-Square	Std Error of the Estimate
1	**.975**	**.949**	**.916**	**7.02218**

a. predictors (constant), public invest. Private invest

ANOVA

Model	d	R-square	Means square	f	Sig.
Regression	6731.308	2	1346.334	26866	.000
Residual	350.243	27	50.115		
Total	7082.057	29			

a. Predictors (constant) pub. Invest, priv. invest
b. Dependent variable aggscore.

Coefficient

Model	Unstandardised coefficient		Standardized coefficient	1	Sig.
(constant)	24.248	13.407	150	3.809	.042
Pub. Invest	-1354	2.419	236	5.537	.013
Priv. invent	2.247	2.551		4.238	.023

a. Dependent variable aggscore

The results showed that there is a strong significant relationship between residential environmental quality and residential housing investments in the study area r^2 = o.949. This is the coefficient of determination. This value means that 94.9% of variation in the dependent variable (environmental quality) can be predicted from the independent variables (public and private investments).

However to generalize the finding to the population beyond the sample, the adjusted r^2 is employed. Adjusted r^2 = .915. This shows that the best coefficient of determination is 91.5%. Thus, 91.5% (explained variance) of the variables is capable of predicting the value of environmental quality in the area. This, then leaves 8.5% of the variation unexplained, suggesting that the explanatory variables could be regarded as being high.

Also P = .00 and P < 0.05 significant level. Interestingly, the public investment has p value of 0.13 and private investment p value of 0.023 which were all significant at 0.05 significant level. The standard error of the estimation = 7.02218, which is the standard deviation of the error term.

To measure the significant interactions in the model, the coefficients of the independent variables were employed. The coefficient 'a' table indicates the relative impacts of each variable on the dependent variable. It reveals the ability of each individual independent variable to predict the dependent variable. It is pertinent, however, to note here that private housing investment variable has more negative impact on the environmental quality of the area than public housing investment. This suggests that housing investments in the study area are more of privately based than of public involvement.

It is important to note that none of the coefficient of determination of the variables is equal to zero, showing that the model fits the data. Hence, the coefficients enable one to develop the model for predicting the value of environmental quality. The constant is 24.248. This is the Y intercept, the height of the regression line when it crosses the Y – axis. This is the predicted value of environmental quality when all other variables are O or held constant. This could be expressed as'

$Y = a + b_1$ public investment + b_2 private investment + E.

That is

Environmental quality = 24.25-1.35 public investment – 2.25 private investment + 7.02

This could be used to predict the value of the environmental quality of Enugu metropolis.

Conclusion

There is significant negative relationship between housing investments and environmental quality of Enugu Metropolis. Private housing investment variable has more negative impact on the environmental quality of the area than public housing investment.

Besides, as the environmental quality of most urban areas in Nigeria seem to be degenerating particularly as waste management is posing enormous problem, Enugu Metropolis is not an exception. Coupled with other factors, solid wastes have impaired the quality of the surrounding residential environment. The authority saddled with the responsibility of handling the wastes seems to be having among others, problem of available data to effectively operate.

The study has, therefore, developed a model for the measurement of environmental quality of Enugu Metropolis using multiple regression model.

Since the current trend is towards sustainable environment, considering the devastation done to it as a result of modern technologies among others, it is therefore pertinent that the quality of the environment is usually ascertained and appropriate measures taken to ameliorate any adverse situation before it gets out of control. Hence, this model when implored is expected to offer the desired assistance.

REFERENCES

Afon, A. O. (1998) "Use of Residents Environmental Quality indicators in Ogbomesho Core Residential Housing Improvement" *FUTA Environmental Forum*. Vol. X1 No, 4 pp. 12-14.

Alkay E., (2009) The Relationship between Environmental Quality level and Housing sale prices in the Istanbul Metropolitan Area. *Istanbul Technical University Publication*. Vol. 6 No. 1 pp 60-76. -

Allern, y and P. Martinsson (2011) "How Important is Environmental Quality for the poor and what do policy makers know about it" A study on subjective well being in Addis Ababa" SAE working paper services

Bernauer, T. and K. Koubi (2004) "On Political Determination of Environmental Quality" C'IS UNI/ETH. Zurich working Paper No. 2

Cendrero, A and D.W Fischer (1999) "A procedure for Assessing the Environmental Quality of Coastal Areas for Planning and Management" *Journal of Coastal Research*. Vol.13. No. 3 pp 6-8.

Cendrero, Lopez and Adriana (2003) "Indicators and indices of Environmental Quality for Sustainable Assessment in Coastal Areas" Journal *of Coastal Research, Coastal Education and coastal foundation Inc*. vol. 19 No. 4 pp 919- 933.

Ede, N.P, AF Ebakpa and F.C Chukwuigwe (2007) "Determination of Housing and Neighbourhood Quality for Yenegoa, Bayelsa State of Nigeria" *Journal of Nigerian Institute of Town Planners*. Vol. xx. No. 1 p. 107

Ekunekong, E.E and A. Jacobs (1998) "Public Housing and Environmental perspective on Housing Development in Uyo, Akwa-Ibom State" *FUTA Environmental Forum*. Xii. No. 6 pp. 8-10

Emodi, E.E. (2013) "The role of Housing Investments in the environmental quality of Enugu metropolis. Unpublished Ph.d thesis at university of Nigeria Nsukka.

Majunder, A.K, M.E. Hossain, E, Islam and M. Sarwa (2007) "Urban Environmental Quality Mapping. A perception study of Chittagong Metropolis. Bangladesh" *Kathnandu University. Journal of Science and Technology.* Vol. 1 No. 4. Pp. 10-11.

Makinwa, P .K (1981) *Internal Migration and Development in Nigeria.* Ibadan Heineman.

Millington, A.F (1982) *An Introduction to Property Valuation* (2nd ed.) London. The Estate Gazette ltd.

Min of information Enugu State (2002) The History of Enugu. Retrieved 2 June 2007 from htt/en.wilipedia.org/wiki/Enugu State.

National Population Commission (2006) Population and Housing census of Federal Republic of Nigeria: *Housing Characteristics* Vol. II No. 4 pp. 12-16.

Muoghalu, L N (1996) "Acute Urban Housing Shortage Amidst increasing Housing stock in Nigeria. A search for causes" *Journal of Nigerian institute of Builders*. Vol. 1 p. 8.

Nwafor, J.C. (2008) "Integrating Environmental Impact Assessment into Planning and Development at the Local Government and Stale Levels for Increased Revenue Generation in Good Governance. A case study of Enugu State" Paper Presented during a 3 day workshop of Centre for Environmental Management and Control (CEMAC) at Zodiac Hotel, Enugu. March 21-24.

Olarenwaju, D.O and G. fadairo (2003) "Flooding as an induced environmental problem. A case study of Ala River and Akure, Nigeria" *Journal of Nigerian Institute of Town Planners* vol. XVI. No. 85-95.

Olorunfemi, F. B. (2009) "Willingness to Pay for Improved Environmental Quality Among residents living in close proximity to landfills in Lagos metropolis Nigeria" *Ethiopian Journal of Environmental Studies and Management*. Vol. 2. No.3 pp 2 1-22.

Okeke, D.C (2002) "Urban Land Use Planning and Informal Sector Syndrome. A Case Study of Enugu" *Journal of Nigerian Institute of Town Planners*. Vol. xiii. Pp56- 64.
Okeke, E .A. (2004) "Demand Factors in Property Values" *Journal of Nigerian institution of Estate Surveyors and Valuers*. Vol. 3 No. 6 pp 14-16
Okpala, D.C (1982) "A note on shifts in housing form: Explaining the paradox of increasing urban housing stock and increasing shortage of housing units in Nigeria" *Nigerian Institute of Town Planners Journal*. Vol. 2 No. 1 and 2. Oct.
Palma, D and A. Anndre (2007) "Accessibility and Environmental Inequality in the Paris Housing Market" *European Transport Publication*. No. 36. Pp. 47-74
Perz, S.G. (2011) "The Quality of Urban Environment in the Brazilian Amazon" *Journal of Social Indicators Research*. Vol. 49 No. 2 pp 181-212.
Richmond, D (1985) *Introduction to Valuation* (2nd ed.) London. Macmillan Publishers Ltd.
Umeakuka, J.M and H.C Mba (1999) "Waste Management practices. A Case Study of Anambra State" *Journal of the Nigerian institute of Town Planners* Vol. Xii pp.
14-25.

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