ESTABLISHING THE CONTRIBUTIONS OF INDIVIDUAL EXPLANATORY VARIABLES TO PROPERTY VALUES IN ANAMBRA STATE: A CASE STUDY OF ONITSHA

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Abstract

One can argue that in the property market, the individual contribution of land and building variables to the overall property value is very uncertain. These explanatory variables which are the attributes that one might think are important in the relevant market go a long way to defining the value of a property. It therefore becomes imperative to establish the contributions of explanatory variables to property value to ensure that future valuations of property for all purposes incorporate the significance of the variables in arriving at values. The land value, building value and property value were generated in excel sheet and some qualitative data (e.g nature of building, floor finishing, etc) were turned into quantitative data and Stata SE9 was employed to develop a property value model. This helped to explain the importance and significance of the variables that affect property value and to emphasize the relationship between land value and property value, hence the need for land value to be taxed. All lands and building variables, except age of building have positive coefficients. At 0.05 level of significance four out of ten building variables and two out of three land variables were significant in the model. The study showed that land value variables are very significant; hence they contribute a great deal to the overall property value.

Keywords: land value, building value, property value, value determinants

Introduction

The need to assist real estate professionals with information on the influence of property features/variables on residential property values cannot be over stressed. The study of the impact of only a component or attribute to draw a general conclusion on the entire rental value of a property without regards to other components may not be sufficient to justify a convincing result (Jiboye, 2004). When the impact of a variable is known, the degree to which it affects the value of a property becomes imperative. *S*cholars and researchers such as Sunderman and Birch

(2000), Yomraliooglu and Nisanci (2004) have carried out extensive studies on the various determinants of land values. Kauko (2003) listed a set of attributes that are seen to influence property values and commonly used in property valuation research. They include; accessibility factors, neighbourhood level factors, specific negative externalities, public services, taxes, and density factors.

Several works have been done by Nigerian scholars from different disciplines to explain the determinants or variables of land value, their relationship with each other and property value. Olayiwola, Adeleye and Oduwaye (2006) examined the relationship that exists between various land value determinants in metropolitan Lagos, Nigeria. The study showed that a high level of co-variation existed between factors of land value such as accessibility, rent, and transport improvement, quality of neighborhood, infrastructural facilities and government regulations. The need for land use planners to consider these land value determinants in putting land into optimum use were highlighted. Ogbuefi and Egbenta (2002) studied the relationship between transport services and property values in Enugu, Nigeria. They employed linear regression to determine the relationship between mean monthly rental values (of 16 properties within the same neighborhood) and time distance by bus. The major variables employed were the monthly rental data for ten years (1990-2000) property characteristics and distance measured by time to the CBD. Their study concluded that time distance is a very poor predictor of value and that with good transportation services people can afford to stay anywhere outside the city centre and enjoy the services provided in the CBD. They agreed that there are several and complex factors that should be considered in analyzing rental value and that location factors in relation to the distance alone are not a significant predictor of value. In another study, Oduwaye (2005) examined land values in high density residential neighbourhoods in Metropolitan Lagos and identified that residential segregation exists in Nigerian cities and the study area. The findings reveal that there are strong relationships between the residential land value variables (rent, cost of purchase of apartment) and cost of a plot of land. The outcome of the study showed that infrastructural facilities and economic variables are the major determinants of residential land values in high density residential neighbourhoods in Lagos metropolis. Emoh, Oni and Egolum (2013) attempt a comprehensive investigation into the factors influencing residential land values in Onitsha, Anambra State of Nigeria. They analysed the various factors influencing land values in Onitsha and how the contribution of different variables to land value variation changes with time. By using regression analysis, they established, prioritized and ranked 13 main factors shaping land values in Onitsha as accessibility, neighborhood quality, land title, zoning regulations, transportation, rent, improvement tax, environmental quality, view of amenities, travel time to the city centre and irrevocable power of attorney.

Extant literatures succeeded in establishing that land and building value attributes are strong determinants of property value but to what extent or degree is not known. It is against this background, that this study examines the exploratory variables of residential properties and uses a model to determine the degree of influence of land and building attributes on property values and not mere deductions.

Area of Study

Anambra state is one of the six states in South East Geographical zones of Nigeria and the second most urbanized state in Nigeria, with 62% of its total population living in urban areas (National Bureau of statistics, 2006).

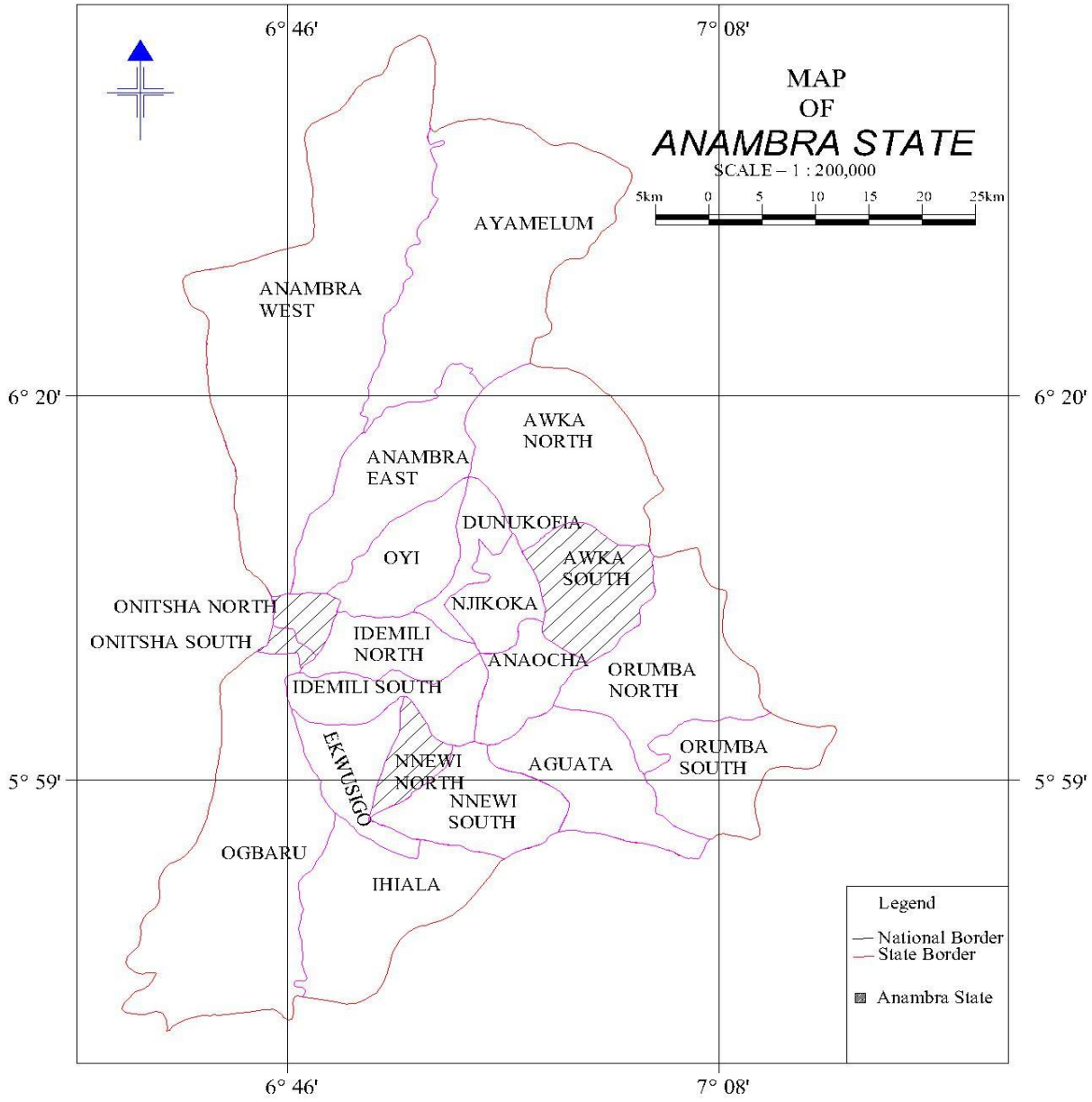

Figure 1: Map of Anambra State showing the study areas
Source: Department of Surveying and Geoinformatics, Nnamdi Azikiwe University, Awka.

Brief description of Onitsha

Onitsha is the gateway to eastern Nigeria and economic nerve centre of Nigeria and occupies the eastern bank of River Niger. It covers an area of about covering some 50 square kilometers. The city is split up into two Local Government areas namely, Onitsha South and Onitsha North Local Government Areas. Onitsha North and South Local Government Areas are bounded by Ogbaru Local Government to the south, Idemili North and Oyi Local Governments to the East. They are bounded to the North by Anambra East Local Government.

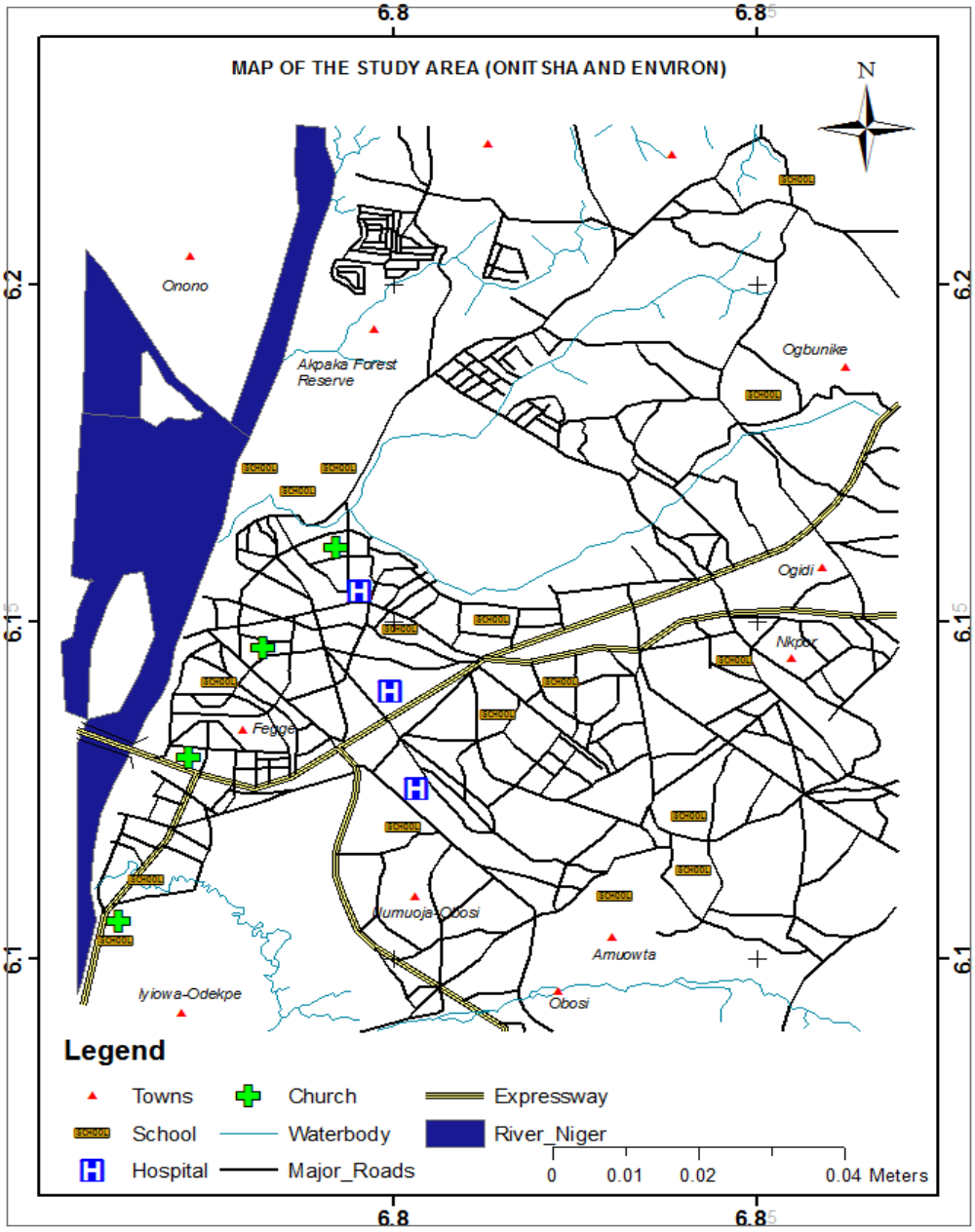

Figure 2: Map of Onitsha

Source: Department of Surveying and Geoinformatics, Nnamdi Azikiwe University, Awka,

The central business district (CBD) of Onitsha is around the main market. The city grew from its initial settlement around the River Niger to what it is today with various land uses. Residential land use (low, medium and high-density areas) plays out in the land use in the study area.

There are several markets in Onitsha though Onitsha main market is the major one that is known within the continent. The influx of traders from all parts of the country and the Cameroon to buy at Onitsha main market is an important factor that invariably contributed to the towns physical and population growths. A major feature of the Onitsha's growth and attraction of traders over the years is that non-indigenes accounted for more than 70% the total population. The land uses in Onitsha are dominated mainly by housing which are mostly of medium and high-density developments. Commercial activities abound everywhere in the town and sometimes one finds it difficult to separate it from other land uses in the town.

Attributes/ Value Descriptors of a Valuation Model of a Residential Property

Attributes or value descriptors that make up a generic valuation model for a residential property are the characteristics of the property. They are such things as the size, land use, neighborhood etc. They can be classified into two groups, Building Descriptors and Land Descriptors.

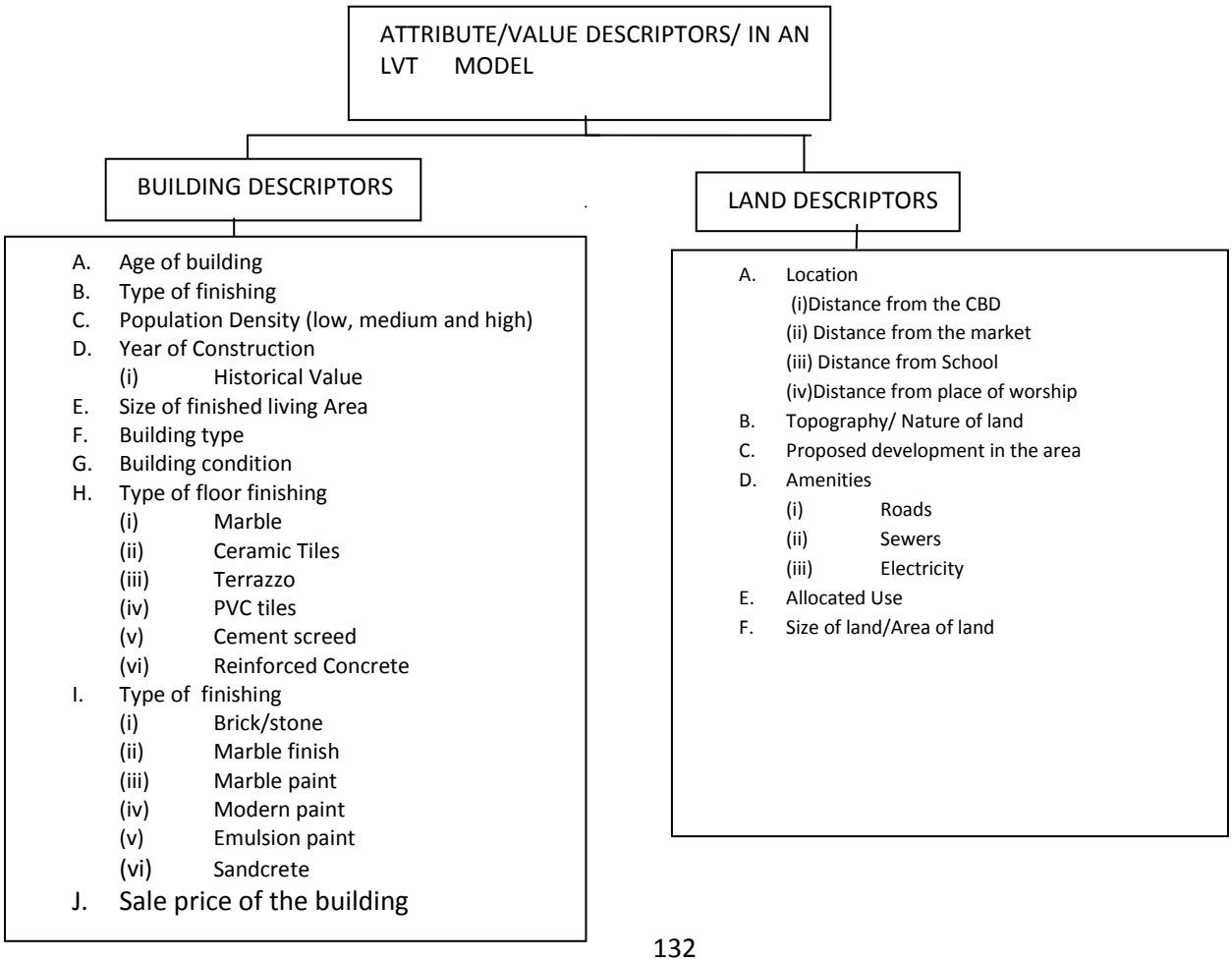

Fig 3: Value Descriptors in a Valuation Model

Igwe, Onyejiaka & Ugonabo (2019)

In developing a model, one is constantly faced with a task of ascertaining which of these descriptors will form part of it. The importance of an attribute is known only after the data have been analysed. Therefore, more attributes are usually collected than are needed for valuation (Ping, 2005). Relationships usually exist between descriptors but generally two relationships are seen;

(1) How are the descriptors related to each other?

(2) How does changes in quality and quantity (size) of descriptors relate to changes in value? For example, does every square meter added to the size of a property make the same marginal contribution in value? i.e. are the descriptors related linearly or non-linearly?

Building Descriptors

These are the variables that best describes an improvement or property. These variables are given numerical values before they are imported into the Valuation model. Variables whose values can be quantified easily (finished area, age of building, no of floors, sale price of property, etc) are measured then the rest are quantified by ranking or percentage adjustment (e.g. property type, type of finishing, floor finishes, etc). There are techniques which are used to come up with quantities for descriptor type of variables of which quality class will be one of it. For example the quality of construction can be in a category ranging from

A - Mansion type classification or construction

C -Typical quality of construction

D, E, F - from sub-quality to poor grade construction.

Any descriptor that will be part of any valuation model is usually defined during model specification.

Land Descriptors

Unlike building descriptors, land descriptors are few. Location is the most important of the descriptors. This can be seen in this analogy; people would attach additional value for a well-located land site with special advantage rather than a land site that is not properly located. Another very common descriptor is the lot size or area of the land. Topography as a quality descriptor defines the land as rolling, swampy etc. A numeric quantity which is done as percentage or ratio is attached to it. For example, a level ground will be the basic value of 1.0, higher or rolling ground will have a higher than standard value (1.25) because of distinguishing

characteristics of a rolling terrain (as per good view). Lower level /swampy land will have a value like 0.8 because of poor topography.

RESEARCH METHOD

Quantitative and qualitative research methods were used to analyse the variables. The variables that determine land and building values were determined (based on literature and respondents' opinion), quantified and extrapolated in excel sheet to determine land, building and property values. The values were then run-in statistical software Stata SE9 to derive models that can establish the significance and influence of explanatory variables to property values.

Approach to Analysis

The approach to analysis is highlighted in figure 4:

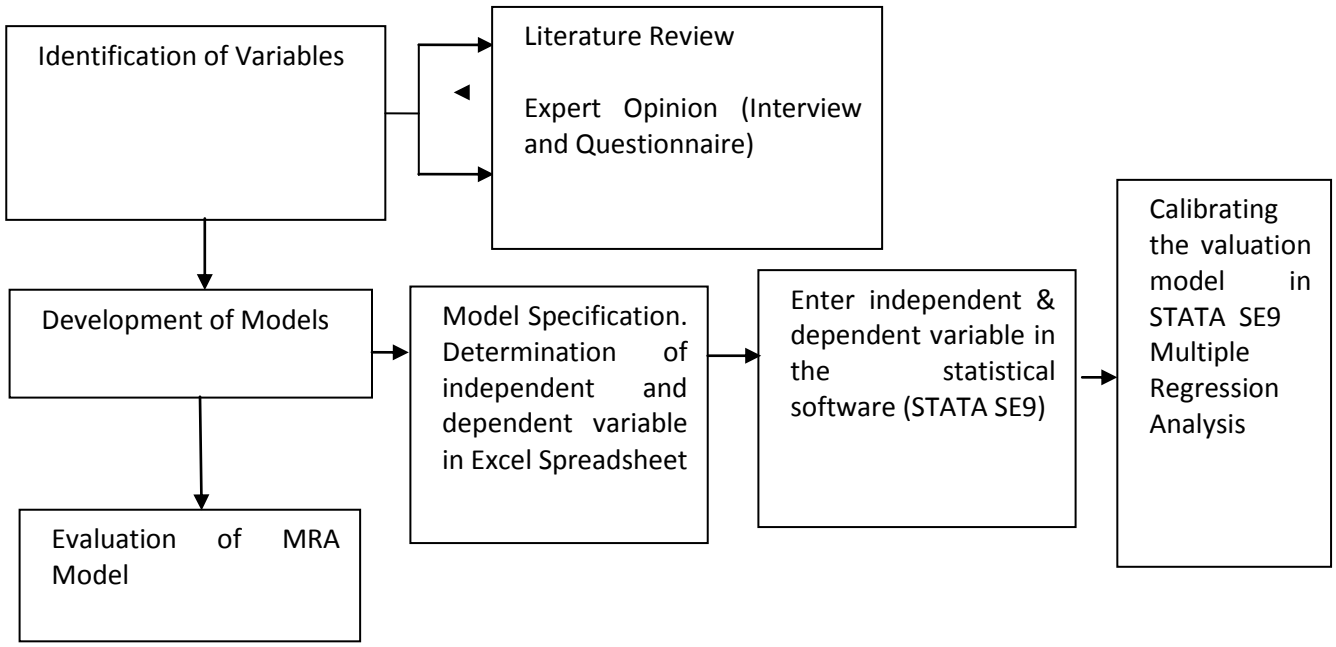

Figure 4: Process for Model Analysis

Identification of Variables

Two avenues were explored in the collection of data at this stage. Firstly, variables were identified using past literatures. Then a given number of variables were listed in the questionnaire to sample respondents' opinion. The variables for land are;

Location factor

(i) Land Area

(ii) Price per plot in the neighborhood (PPIN)

Variables for building are;

(i) Finished Area

(ii) Building condition

(iii) Age of property

(iv) Property Type

(v) No. of Floors

(vi) Nature of Development

(vii) Floor Finish

(viii) Land Use Density

(ix) Type of Finishing

(x) Construction Cost

Ranking of variables

Data on sample properties were collected from the following sources:

(1) Anambra State Housing Development Corporation (ASHDC), Awka.

(2) Anambra Property and land Use Charge Office, Awka.

(3) Professional Estate Surveyors and Valuers and Practicing Estate Surveying and Valuation Firms

Some of the variables which are qualitative in nature (e.g floor finish, nature of development etc) were ranked to obtain a quantitative data thus:

Table 3: Ranking of Variables

VARIABLES	**RANKING CRITERIA**	**RANK**
1. Building Condition	**Condition**	
	Very good	5
	Good	4
	Fair	3
	Poor	2
	Very Poor	1

2. Property Type	**Type**	
	Detached family house/Semi detached family house	8
	Bungalow	7
	1 storey	6
	2 storey	5
	3 storey	4
	4 storey	3
	5 storey	2
	Tenement	1
3. Nature of Development	**Condition**	
	Improved	3
	Not fully improved	2
	Not improved	1
4. Finishing	**Type of Finish**	
	Marble	7
	Brick/Stone	6
	Marble & Paint	5
	Texcote	4
	Modern Paint	3
	Emulsion Paint	2
	Sandcrete	1
5. Floor Finish	**Type Of Finish**	
	Marble	6
	Ceramic tiles	5
	Terrazzo	4
	PVC tiles	3
	Cement screed	2
	Reinforced concrete	1
6. Location Factor	**Density**	**Grade**
	Low	1

	Medium	0.8
	High	0.7

Development of Model (Regression Analysis)

After ranking, variables of sample properties were ran and transformed in an excel sheet to obtain land, building and property value. To obtain land value a linearised plot value of each property was worked out. The plot linearised value is multiplied with the price per plot in the neighborhood and the location factor to arrive at the land value thus;

Land Value = $Plot\ LV * PPIN \ldots\ldots equation\ 1$

LA represents Land Area; Loc. Fac is Location Factor; Plot LV is Plot Linearised Value (Land Area/Standard Plot Size in the Neighborhood); PPIN- Price of Property in the Neighborhood.

For building values, variables like floor finishes, property type, building condition, nature of development, were quantified. Their values with the other values of the variables helped obtain a quality class (in an excel spreadsheet). The quality class is the multiplying factor that was applied on the cost of construction to obtain the building value thus;

Quality Class(QC)= $Typ.of\ Fin.* Bld.con.* Age * nat.of\ Dev.* No.of\ Flrs\ \ Ppty.Typ.* Flr.Fin \ldots\ldots equation\ 2$

Where: Typ. of Fin - Type of finish;

Bld. Con - Building Condition;

Nat. of Dev - Nature of Development;

No. of Flrs- Number of Floors;

Ppty. Typ- Property Type;

Flr. Fin - Floor Finish.

BuildingValue= $Fin\ lvgArea.* Loc.Fac * Sqrt\ Fin.lvg.area * QC * Cost\ of\ Cons \ldots\ldots\ldots equation\ 3 =$

Where;

Fin lvg. area represents Finished living area;

Cost of Cons. is Cost of Construction;

loc.fac is location factor;

sqrt fin.lvg area is Square root of finished living area

This gives a basic property value model of structure:

$$Property\ Value = Land\ Value + Building\ Value \ldots\ldots\ldots\ldots\ldots equation\ 4$$

$$Land\ Value = Property\ Value - Building\ Value \ldots\ldots\ldots\ldots\ldots equation\ 5$$

$$Land\ Value = Property\ Value - No.of\ Flrs * \%Typ.of\ Fin.* \%Bld.con.* Age\ LV * \%nat.of\ Dev.* \%Ppty\ .Typ.* \%Flr.Fin * Fin.lvg\ area * Loc.Fac * SQRT\ fin.lvg\ area$$

Twenty land, building and property values were taken from low density and high-density areas, giving a total of forty land, building and property values. Medium density properties were excluded because it was noticed that there is a very slight margin between the property values in the medium density areas and high-density areas thus will not give room for better representation.

Table 4: The excel spreadsheet for land and building values of the sample properties in Onitsha G.R.A

Land Area	Finished Area (size)	Type of Finishing	Bld. Cond.	AGE	NAT. OF DEVT	NO. OF FLRS	PPTY. TYPE	FLR. FIN	LOC. FAC	PPIN	PLOT LV	LAN VAI
2370	1060.6	1	2	1	2	1	8	1	1	18000000	2.633333	47400
4171	2020	5	5	2	3	1	7	3	1	18000000	4.634444	83420
2200	1010	3	4	9	3	2	7	5	1	18000000	2.444444	44000
2105	1474	3	3	10	3	2	6	3	1	18000000	2.338889	42100
4225	2367	6	5	5	3	2	7	5	1	18000000	4.694444	84500
1114	651	3	4	16	3	2	6	4	1	18000000	1.237778	22280
1212	891	6	5	10	3	2	6	4	1	18000000	1.346667	24240
989	633	3	5	3	3	2	7	5	1	18000000	1.098889	19780
2122	1289	4	4	18	3	2	7	4	1	18000000	2.357778	42440
1678	1141	3	4	12	3	2	7	5	1	18000000	1.864444	33560
1989	1205	4	5	4	3	2	6	5	1	18000000	2.21	39780
2562	1802	3	2	25	3	2	6	5	1	18000000	2.846667	51240
2022	1524	3	4	32	3	2	5	4	1	18000000	2.246667	40440
814	565	3	4	20	3	2	5	1	1	18000000	0.904444	16280
1009	718	3	2	25	3	2	6	1	1	18000000	1.121111	20180
4106	2766	7	5	4	3	2	7	1	1	18000000	4.562222	82120
765	461	3	5	8	3	3	8	6	1	18000000	0.85	15300
704	442	3	2	14	3	2	8	3	1	18000000	0.782222	14080
1128	682	3	4	12	3	2	7	1	1	18000000	1.253333	22560
902	604	4	4	20	3	2	7	3	1	18000000	1.002222	18040

These values were ran in Stata SE9 statistical software. Three non-linear/hybrid models that can accommodate both multiplicative and additive terms of land and building value were formed. These models took the form of regression equation with dummy regressors as suggested by Gujarati 0. (2009).The models are presented as follows:

Model 1: Land Value Model

To show the determinants of land value, a model is specified with land value as dependent variable and the variables that are potential determinants are specified as explanatory variables. This is shown in equation 1 below.

$$LogLV = \alpha_0 + \alpha_1 Size + \alpha_2 Dumloc + \alpha_3 Dumdens + \alpha_4 Dumlocdens + \mu \ldots . equation\ 5$$

Where Log LV represents log of Land Value (the dependent variable), α_0 is the constant, while α_1 to α_4 represent the coefficient of the independent variables. The independent variables in the model are size (size of land), Dumloc (dummy for location), Dumdens (dummy for density), Dumlocdens (interactive dummy for location and density). μ is the stochastic error term. For the location dummy, Awka is specified as the base category. That is to say that Awka is denoted as 1 in the data set while Onitsha is denoted as 0. In the dataset for density, the low density area is used as the base category. This means that the low density area is denoted as 1 while the high density area is denoted as 0. In both Awka and Onitsha, GRA is the low density area.

Model 2: Building Value Model

This second equation was used to estimate the determinants of building value.

$$LogBV = \beta_0 + \beta_1 Fin + \beta_2 Con + \beta_3 Age + \beta_4 Nat + \beta_5 Floor + \beta_6 Storey + \beta_7 Type + \beta_8 La + \beta_9 LogSize + \beta_{10} Dumdens + \varepsilon \quad \ldots\ldots\ldots\ldots\ldots equation\ 6$$

Where Log BV represents building value, β_0 is the constant term, while β_1 to β_{10}represents the coefficient of the independent variables. The independent variables in the model are fin (external house finishing), con (condition of building), age (age of the building), nature (nature of development), floor (the type of floor finishing-i.e. tile, etc.), storey (number of storey in the building), type (type of building-eg bungalow, duplex, etc.), La (living area i.e area occupied by the building), Log of size, Dumdens (dummy for density). Just like in the first model, low density is the base category, denoted as 1 in the data set while high density is denoted as 0. The dummy of location and density are the same as of equation 1 across all equations if specified in the model.

Model 3: Property Value Model

The third equation was used to estimate the determinant of property value

$$LogPV = \gamma_0 + \gamma_1 Con + \gamma_2 Age + \gamma_3 Nature + \gamma_4 Floor + \gamma_5 Lasize + \gamma_6 Logsize + \gamma_7 Dumdens + \pi \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots equation\ 7$$

Log PV is log of property value, Lasize is the living area size ratio. Every other variable are as explained in equation 5 and equation 6. The constant term is denoted in the model as γ_0, while γ_1 to γ_6 are the coefficient of the independent variables. π is the stochastic error term.

With the development of the model the significance of the variables to the land, building or property values were brought to fore. Most importantly the result of the model analysis was kept side by side the literature on land value taxation to evaluate the contribution of land variables and building variables to property values hence the need to tax land value or not.

The multiple regression analysis is relevant to this study as it assists in estimating the dependent variables from the independent variables and modeling the relationships between the variables. Another order of hybrid multiple regression models was used to test the set hypotheses, explain the variables and estimated values which comply with the researcher's expectation better than the result of the basic regression model.

Evaluation of Model

Model Testing: Some performance measures (statistics) were used to evaluate the model after calibration and specification. This is done to know:

- How good the model result is;
- If the model is reasonable and rational.

The model was tested with various parameters like:

Coefficients

The coefficients define the size of each independent variable and give the magnitude of the effect the variable is having on the dependent variable. The sign on the coefficient (positive or negative) gives the direction of the effect. In multiple regression analysis like this, with multiple independent variables, the coefficient tells how much the dependent variable is expected to increase when the independent variable increases by one, holding all the other independent variables constant.

T-Statistics

This was used to verify whether there is a significant influence of each of the variables on the land or building values even when the coefficients indicates a positive or negative relationship. When t is large, one can be confident that the variable is significant in the prediction of value, conversely when t is small, it cannot be said that the variable is not related to value or is unimportant in explaining value because t values measure marginal contribution of a variable in predicting values when all other variable are held constant. As a result some variables duplicate or interfere with other variables information and even when they may be highly correlated with value they are insignificant predictors as indicated by their t-values.

Again, some variables can predict values in combination of other variables but individually they may not be correlated with value (land and building).

Generally, provided that sample size is large a t-statistic in excess of ± 2 indicates that one can be 95% confident and that the variable is significant in predicting value.

Results of the nonlinear models were finally tested on the combined value-Estimated market value and separately on the building and land value.

RESULTS AND DISCUSSIONS

Land value Model

The study adopted a regression approach to the statistical modelling. Given that location, density and size are the core variables that affect land value, they were used to develop a land value model as presented in table 5. The log of land value is the dependent variable; while dummy for location, dummy for density, and interactive dummy of both location and density are all explanatory variables. The density was categorized into low density and high-density area. The low-density area is the area with low population density and vice versa. For the study, GRA is classified as low-density area and was used as the base category.

Table 5: Land Value Model

Variable	**Coefficient**	**t-statistics**	**Prob. of t-statistics**
Log Land Value	*Dependent variable*		
Size	0.0002266	20.04	0.00
Dumloc	-0.4740567	-17.96	0.00
Dumdens	0.5727094	19.78	0.00
Dumlocdens	0.2843725	7.81	0.00
Cons	6.794567	345.09	0.00
R-Squared	0.9694		
Adjusted R-Squared	0.9677		
F-Square	593.58		

From the result, the parameter sign of the coefficients is positive for all the variables with the exception of location dummy. The probability of t-statistics for the location (0.00) is less than 0.05, as such, the relationship established is significant. The dummy of density is positive and significant. The implication is that land value in low density area tends to be more expensive than in high density area. The coefficient for size is positive and significant as expected. Hence size significantly affects the value of land.

A statistical model similar to that of land value was also designed for the building value. Table 6 shows the result.

Table 6: Building Value Model

Variable	Coefficient	t-statistics	Prob. of t-statistics
Log of building value	Dependent Variable		
Finishing	0.0374282	0.78	0.435
Condition	0.1782982	3.55	0.001
Age	-0.0322225	-5.49	0.000

Nature	0.2366449	1.33	0.188
Floor	0.1557906	3.70	0.00
Storey	0.049139	1.25	0.214
Type	0.0882039	3.36	0.001
Living area	0.1285908	0.38	0.706
Log of size	1.453648	9.16	0.000
Dumdens	1.086477	7.38	0.000
R-Squared	0.9974		
Adjusted R-Squared	0.9971		
F-Statistics	2706.39		

Type of finishing, condition of building, age, nature, floor type, number of storeys, type of building, and living area were introduced to the building model. Also, the dummy for location, density and the interactive dummy were also added. However, the location dummy and the interaction dummy were earlier introduced but later dropped because they were wrongly signed and statistically insignificant.

The result presented in table 6 showed that the coefficient of type of finishing is positive but not significant implying that though the type of finishing should positively affect the value of a building, such effect is not significant. Similarly, condition of building has positive coefficient. That is to say that the condition of building affects the value of a building positively and this effect is significant. The age of the building is the only variable that has a negative coefficient. The variable is also significant. The sense to be made is that the older a building is, the lesser its value. And since it is significant, the variable is very important in determining the value of a building. The coefficient of nature of the building numbers of floors, and living area are all positive and insignificant. The implication is that these variables are not significant factors that affect building value. On the other hand, the coefficient of floor finishing, type of building, size of land and the density of the area are all positive and significant. By implication, floor finishing significantly increases the value of building. Also, the type of building, size of land and the density of the area significantly increases the value of land.

A third model was built for property value to establish the significance of the variables.

Table 7: Property Value Model

Log of Property Value	Coefficient	t-statistics	Prob. Of t-statistic
Condition	0.0657537	2.75	0.007
Age	-0.0090955	-3.17	0.002
Nature	0.4356841	4.84	0.000
Floor	0.0398732	1.84	0.070
Living area/size ratio	0.6433765	3.87	0.000
Log of size	1.841939	23.50	0.000
Dumdens	0.4233793	6.53	0.000
R-Squared	0.9994		
Adjusted R-Squared	0.9993		
F-Square	17357.55		

This property value model puts into consideration variables that should affect the value of a property. The variables in the land model and as well as that of building model are adapted into the property model. However, at first run, some of the variable were wrongly signed and insignificant hence not very relevant to the model. Such variables were therefore dropped. Hence the explanatory variables in the property value model are condition of the building, age, nature, type of floor finishing, living area as a ratio of size of land, log of size and the dummy for density. The dummy for location was wrongly signed and insignificant. As such it was dropped. Similarly, the interactive dummy for location and density was dropped also. Dropping these variables improved the performance of the rest of the variables in the model implying that they are not very important variables in the model. However, since dummy for density is significant across all three models, it implies that the density of the area is an important factor in the decision of the average buyer as such it affects the value of both land, building and in turn the property. It is indicative that the value of land, building or property is higher in low-density area (in the case of this study the GRA) than they are in high-density area (Fegge).

All the variables in the model with the exception of age have positive and significant coefficients. That is to say that the condition of the building, nature of building, floor type, living area, size of land and density of the area all have positive and significant effects on the value of a property. The age of a building on the other hand have negative but significant coefficient. The implication is the age of a building reduces the value of a building. Finally, this study has opened otherwise hidden aspects of land and building value and has reinforced the effect and significance of factors like density of an area, no. of floors; land size etc has on building, land and property value.

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