

Assessment of the Contribution of Environmental Attributes to Residential Property Rental Value in Abuja

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The contribution of environmental attributes in residential price determination is premised on the issue relating to inefficient attributes pricing. The study analysed three environmental attributes such as structural, neighbourhood and natural attributes of the environment with a view to determining its hedonic value upon which residential property price is derived. In order to achieve the aim of the study, a sample size of 2401 was drawn out of 104166 properties using estimation method; 50% estimation rate and precision range of ± 4 were adopted in estimating the sample size. The study administered two set of structured questionnaires; one to Estate Surveyor and Valuer firms to collect data on rental values (2008-2019) and second questionnaires were administered on the respondents to collect information on condition of environmental attributes using the census and simple random sampling method technique. Hedonic regression was employed to analyse the data. Environmental attributes were scored based on current condition and ratio scale was used alongside the average property value. The result revealed that neighbourhood attributes contributed between 60.3% -71.6%, natural attributes contributed between 60.3%-71.7% while structural attributes contributed between 66.8%-75.1% in determining the property values across the selected areas. The result of mixed regression analyses further revealed that environmental attributes contributed about 70.1% in determining the value of property in the selected areas. Environmental attributes such as natural and man-made water supply, road, quality wall-structure and floor, landscape, bathroom and streetlight contributed significantly in the determination of property values across the study areas. The study therefore concludes that the value of environmental amenity should be captured in the price of residential properties close to it. It is recommended that every stakeholders in the built environmental advocate for quality and even distribution of common environmental facilities that are key to development of property market in Nigeria.

Keywords: Environmental attributes, Residential property, Property values, Rent, Neighbourhood

INTRODUCTION

Property value is a function of environmental quality, and determines the viability of property investment (Bourassa *et al.*, 2007). When a household chooses a house or apartment, it is choosing much more than a dwelling but also a set of local public goods (Sullivan, 2012). Therefore, man's attitude towards the surrounding environment is not neutral but to search for locations that deliver a high quality of life. Those expectations particularly concern man's daily surroundings especially the residential areas. The decisions made on the real estate market is largely dependent on the quality of an environment (Cellmer *et al.*, 2012). Residential property has long been recognised as an important component in a household's overall wealth. According to a study in the US, residential properties represent roughly two-thirds of the household's overall assets (Davis & Heathcote, 2007). It is therefore, one of the basic needs of man and it is the most important for the physical survival of man after the provision of food (Campbell *et al.*, 2007). Residential property is an enclosed shelter where people live in. In addition to it, local public facilities are also necessary to create a good living environment. Property is a multi-dimensional product and the number and nature of

factors that influence its value are equally of different kinds (Paz, 2006). According to Ge and Du (2007), property value is an essential aspect of property markets worldwide and determined by a variety of factors and the determination of those factors is a significant part of property valuation. The proximate principle suggests that the value of environmental amenity is partially captured in the price of residential properties close to it (Nicholls & Crompton, 2018). Example is the case of Abuja and alteration occurring in rent movement invariably impacts each and all type of residential property though in variable levels. Environmental attributes is an important determinant of real estate value, and it is the critical factor as regards the prices of residential property (Madushani *et al.*, 2019). Environmental features significantly contribute to the prices quoted on local property markets. The presence of environmental attributes and the arrangement of those spatial features directly affect buyers' attitude and the value of property. Environmental attributes are largely categorized into structural (physical characteristics), locational and neighbourhood attributes (Yusof & Ismail, 2012; Samy, 2015). Tse and Love (2000) further identified four categories of environmental attributes namely structural, neighbourhood, locational and

natural to measure residential property values using a hedonic equation in Hong Kong. The failure to price these attributes individually across locations have remained unrevealed. This has caused significant variation in rental values across residential markets in Abuja creating a high demand for environmental preferences among the rentals, and also difference in the provision of environmental amenities across the locations (Oloke *et al.*, 2013). The relative price of a house is the summation of all its marginal or implicit prices estimated through the regression analysis. The studies of Ong *et al.* (2003), Berry *et al.* (2003) and Wilhelinsson, (2008) are based on empirical modelling of physical housing attributes like the number of rooms and bathrooms, living areas and other areas. In the work of Kemiki *et al.* (2015), where the major determinant of rent was identified for M.I. Wushishi Estate in Minna, the study did not compare rent with other location and the rent in such location is not market-determined. Only structural attributes were examined without taken into consideration neighbourhood and location attributes, hence there exist gap that need to fill. Numerous studies have utilized this technique to examine the relationship between attribute preference and the price of properties across Europe and American countries (McClauskey *et al.*, 2008; Fletcher *et al.*, 2000; Samy, 2015) but studies have not been fully explored in African countries especially in Nigeria where the neighbourhood attributes is not a determinant of property value and not traded explicitly (Owusu, 2012). It is important to establish the relationship and magnitude of influence of these environmental variables on property in Abuja, Nigeria. Thus, the study has been prompted by the need to assess the contribution of environmental attributes on residential property value in Abuja using the hedonic model.

LITERATURE REVIEW

Environment is a difficult word to define because the study of environment is based on different disciplines of knowledge, like nature sciences, ecology, atmosphere, sciences, oceanology and life (Kumar, 2018). He further said that its conventional meaning relates to surroundings, but obviously that is a concept which is relatable to whatever object it is which is surrounded. Cellmer *et al.* (2012) further identified three key environmental attributes as the presence of surface water bodies such as lakes, ponds and watercourses, forest cover and land elevation. Their study revealed that the price of properties that directly overlook a lake may be three times higher in comparison with properties that are not attractively located. Kamali *et al.* (2008) further grouped the variables determining property values into; environmental variables, neighbourhood variables, accessibility (location) variables and property

variables. Residential properties according to Nikolaos *et al.* (2011) are properties providing housing accommodation. They are generally constructed to mean properties primarily acquired for residence. It has the attribute of giving shelter, security, comfort, privacy, investment and personal identity. Nichols and Crompton (2017), classified the form in which residential property can be owned into multi-tenanted, owner occupied and single tenant property. Property value is defined as the highest price in terms of money which a particular property will fetch in the open market under a free market condition (Samy, 2015). In the word of Igbiosa (2011), property value is the amount of money which can be obtained for the interest on a property at a particular time from persons able and willing to purchase it. There are only two well-known forms of property value such as capital value and rental value. Previous research has found that the value of residential properties depends on a number of characteristics because housing is a heterogeneous commodity. Kauko (2003) listed a set of attributes that has been commonly used in property valuation research including accessibility factors, neighbourhood level factors, specific negative externalities, public services, taxes, and density factors. McClauskey *et al.* (2008) measured the effect of location on residential house prices using the Ordnance survey of Northern Ireland data. The attributes they considered in their multiple regression model, calibrated by location adjustment factors, is sale price, date of sale, age of property, size, number of bedrooms and bathrooms, number of garages, type of central heating, condition, neighbourhood and group cluster. Cellmer *et al.* (2012) conducted a research in Poland on the effect of environmental factors on real estate value using cokriging methods. The applied methodology was based mostly on the modelling of spatial correlations with the involvement of statistical and geostatistical techniques. These methods support an assessment of the spatial structure of the analysed processes and the determination of environmental attributes' direct impact on the prices and value of property. However, Nikolaos *et al.* (2011) studied four elements affecting real estate market values in Greece which are green spaces, wetlands, topography and environmental risks. Similarly, Oloke *et al.* (2013) observed that the relationship among accessibility, property values and land use patterns in Lagos has been the pre-occupation of earliest theorists with indication that travel costs were traded off against rents, population densities and distances from the Central Business District. This study assesses the veracity of this proposition in Magodo neighbourhood property market and the impact of other factors such as locational, structural and neighbourhood characteristics. It was found amongst other things that

travel distance and cost does not affect residential property value as others factors do.

Table 1: Summary of Studies on Environmental Attributes

Authors	Environmental Attributes
(Joslin, 2005)	Location Age Size
(Tse & Love, 2000)	Shopping centres
(Kauko, 2003)	Highway Parks Metro Neighbourhood characteristics
(Han, Yu, Malone-Lee, & Basuki, 2002)	Parks Central Business District Schools
(McCluskey, Deddis, Lamont, & Borst, 2008)	Location
(Sirmans <i>et al</i> , 2008)	Total area of house Number of fire place Number of car garages

Source: Elleh (2005)

RESEARCH METHODOLOGY

The study adopted quantitative method of research approach. Two structured questionnaires were administered on respondents which included Estate Surveyors and Valuers (ESV) and residents. One set was administered to collect trend in rental values (2008-2019) from registered estate surveyors and valuers firms while the second set was administered on residents of residential areas to collect information on state of environmental attributes using the census and simple random sampling technique. This is to ensure that every property have the equal chance to be selected. In order to get fair representation of information and data for useful analysis from the study areas, multi-stage sampling technique was considered appropriate and was subsequently adopted by delineating Abuja into neighbourhoods, then into residential densities (low, medium and high). The population for the study area was obtained from six (6) distinct geographical neighbourhoods in Abuja. Six (6) neighbourhoods were randomly selected from the delineated zones and they form the sample areas for this study. The selection of these locations is based on practical considerations that Abuja is known for its splendid contemporary architecture, beautiful green space. Abuja real estate market is more active and environmental factors affecting their values can be determined. As at the time of this research work, only 93 registered estate firms which represent 75% of the total registered estate firms in the study area were sampled (NIESV DIRECTORY

2017). The total number of residential rented properties under study were 104,166 while a sample size of 2401 was obtained using the Adams, Hafiz, Raeside and White (2007) simplified formula, representing 2.3% of the total number of rented residential properties in the study areas. The sample size of the neighbourhoods ranges between 9% and 23% of the total sample size (Table 3). Questionnaires were then administered randomly within each neighbourhoods under study. The study utilized hedonic regression modelling through multiple regression approach (based multiple rental approach). The hedonic approach with regression based techniques has been a traditional appraisal approaches, widely used in the residential property valuation (Rosiers *et al.*, 2008; Rossini, 2007). Hedonic price modelling is a useful econometric tool to analyse the price of a heterogeneous good. The study utilized neighbourhood, natural and structural qualities with their respective scores and rental value linearized on natural logarithm for purpose of having non-spurious regression. The model adopted double log form of data linearity. The rental value is denoted by aggregated rental value of residential properties. Where X_s are neighbourhood attributes denoted by X_1 -security patrol, X_2 -street light, X_3 -drainage system X_4 - water supply, X_5 -electricity supply X_6 -communication facilities, X_7 -waste disposal facilities and X_8 -road quality. Where X_s are natural environmental Attributes denoted by X_1 -Serenity, X_2 - Quality of air, X_3 . Natural water quality X_4 - Green area, X_5 - open space and X_6 - weather

condition. Where X_s are structural attributes denoted by X_1 - quality of fence, X_2 - Burglary proof, X_3 . Garage X_4 - Roof type, X_5 - quality of ceiling, X_5 -wall quality, X_5 - floor quality, X_5 -landscape, X_5 -quality electrical fitting, X_5 -no.bedroom, X_5 -no-toilet and X_6 - bathroom.

$$\text{LogY} = a + \beta \log X + e$$

.....Equation (1)

$$\text{Log Y} = a + \beta \log X_1 + \beta \log X_2 + \beta \log X_3 + \beta \log X_4 + \beta \log X_5 + \beta \log X_6 + \beta \log X_5 + \dots + e \dots \dots \dots \text{Equation (2)}$$

RESULTS AND DISCUSSION

The demographic profile of the estate firms in Abuja and the schedule of questionnaire administered to respondents are presented in Tables 2, 3 and 4. The result in Table 2 revealed that most of the estate firms in Abuja obtained their seal in the year 2001 – 2010. This explains why most of the firms were established in the same year 2001 – 2010. Staff size for most firm ranges from 1 – 5 because most of the firm's offices are not big enough to accommodate more than five staff. Majority of the firms prefer to employ male staff due to availability of them during night hours to meet clients who are too busy during the day.

Table 2: Demographic Profile of Estate Firms in Abuja

DEMOGRAPHIC CATEGORY	N	%
YEAR OF ESTABLISHMENT		
1981-1990	0	
1991-2000	10	10.75
2001-2010	50	53.76
2010-2020	33	35.48
NO OF STAFF		
1-5	83	89.25
6-10	10	10.75
11-20	0	
PROFESSIONAL QUALIFICATION		
FNIVS	8	8.6
ANIVS	18	19.35
ANIVS + RSV	67	72.04
STAFF GENDER		
MALE	85	91.40
FEMALE	8	8.6
YEAR SEAL WAS OBTAINED		
1991-2000	10	10.75
2001-2010	55	59.14
2010-2020	28	30.11
Total	93	100

Table 3 shows the number of questionnaires administered on the respondents. In all a total number of 2401 questionnaires were administered with only 1235 questionnaires representing 51.43% of the total

administered questionnaires were properly completed and returned for analysis. This was considered adequate for the analysis, as the analysis was based on the total number of questionnaires returned.

Table 3: Schedule of Questionnaires Administered

Sampling area	Population	Sample size administered	Sample size returned
Wuse II	9438	218	196
Maitama	12976	299	275
Gwarinpa	18126	418	186
Utako	19523	450	177
Kubwa	24685	568	200
Lugbe	19418	448	201
Total	104166*	2401	1235

* Abuja Electricity Distribution Company (AEDC)

The result in Table 4 shows that majority of the respondents were male across the study areas. The

majority of the sampled respondent fall within the age group 41-50years in Maitama, Wuse, Gwarinpa, Utako and Lugbe while only Kubwa fall within the age bracket

of 31-40years. The majority of the sampled respondents across the study areas were married and majorly civil servants. The result of demographic information presented in Table 3 revealed that majority of the sampled respondents had household size between 6 and

10 while Maitama household size is between 1 and 5. The sampled respondents were graduates of tertiary education with an average monthly income of N151, 000 and above.

Table 4: Demographic Profile of Respondents in Abuja

Demographic Category	Category	Maitama		Wuse 2		Gwarinpa		Utako		Kubwa		Lugbe	
		N	%	N	%	N	%	N	%	N	%	N	%
Gender	Male	216	78.5	185	94.4	186	100	161	91.0	17	8.5	157	78.1
	Female	59	21.5	11	5.6			16	9.0	183	91.5	44	21.9
	Total	275	100.0	196	100.0	186	100	177	100.0	200	100.0	201	100.0
Age	20-30yrs	10	3.6	5	2.6	5	2.7	5	2.8	7	3.5	8	4.0
	31-40yrs	105	38.2	84	42.9	74	39.8	65	36.7	86	43.0	86	42.8
	41-50yrs	126	45.8	84	42.9	84	45.2	84	47.5	84	42.0	87	43.3
	>51yrs	34	12.4	23	11.7	23	12.4	23	13.0	23	11.5	20	10.0
	Total	275	100.0	196	100.0	186	100	177	100.0	200	100.0	201	100.0
Marital Status	Single	36	13.1	17	8.7	17	9.1	17	9.6	17	8.5	49	24.4
	Married	215	78.2	167	85.2	157	84.4	148	83.6	183	91.5	152	75.6
	Widowed	24	8.7	12	6.1	12	6.5	12	6.8				
	Total	275	100.0	196	100.0	186	100	177	100.0	200	100.0	201	100.0
Occupation	Civil servant	106	38.5	106	54.1	106	57.0	106	59.9	106	53.0	106	52.7
	private servant	134	48.7	76	38.8	70	37.6	62	35.0	79	39.5	80	39.8
	self-employed	35	12.7	14	7.1	10	5.4	9	5.1	15	7.5	15	7.5
Household Size	1-5	113	41.1	42	21.4	42	22.6	42	23.7	44	22.0	45	22.4
	6-10	106	38.5	98	50.0	88	47.3	79	44.6	100	50.0	100	49.8
	11-15	42	15.3	42	21.4	42	22.6	42	23.7	42	21.0	44	21.9
	16 and above	14	5.1	14	7.1	14	7.5	14	7.9	14	7.0	12	6.0
Education	None												
	Primary												
	Secondary												
Income	Tertiary	275	100.0	196	100.0	186	100	177	100.0	200	100.0	201	100.0
	N50000&less												
	51000-100000											21	10.4
	110000-150000									59	29.5	53	26.4
	151000&above	275	100.0	196	100.0	186	100	177	100.0	141	70.5	127	63.2
	Total	275	100.0	196	100.0	186	100	177	100.0	200	100.0	201	100.0

Table 5 presents the contribution of neighbourhood attributes on rental value. The study revealed 68.4%, 70.1%, 68.9%, 71.6% and 60.3% variation in rental value in Maitama, Wuse, Gwarinpa, Utako, Kubwa and Lugbe residential markets respectively which can be explained by independent variables (neighbourhood attributes) in the model. The result of F-tests across the study areas showed that the model is fit and significant. In Maitama, six independent variables significantly contributed to rental changes in the study areas, such that additional increase in number of street light significantly contribute 42.6% change in rental values, improvement in number of covered drainage significantly contribute 16.4% change in rental value, improved 24hrs supply of public water significantly contribute 23.1% change in rental values, any improvement in communication network facilities significantly contribute 32.8% change

in rental value. Any additional increase in waste disposal facilities significantly contribute 30.4% change in rental value and additional increase in road construction by 1km significantly contributes 58% change in rental values. In Wuse, six independent variables significantly contributed to rental changes in the study areas, such that additional security to the area significantly contribute 11.4% to rental value, additional increase in number of street light significantly contribute 25.1% change in rental value, improvement in number of covered drainage significantly contribute 11.9% change in rental value, improved 24hrs supply of public water significantly cause 21.4% change in rental values, any additional increase in waste disposal facilities significantly cause 21.6% change in rental value and additional increase in road construction by 1km significantly cause 35.1% change in rental values. In

Gwarinpa, five neighbourhood attributes significantly contributed to rental variation in the study area, such that each additional increase in the number of street light significantly contribute 22.7% to rental variation, additional increase in the number of constructed cover-drainage significantly contribute 26.5% to rental variation, improved 24hours public water supply significantly contribute 23.2% to rental variation, additional facility to waste management significantly contributes 30.33% to rental variation and additional construction of quality road by 1km significantly contribute 27.9% to rental variation. Communication facilities had no impact in the rental value increase implying that even if there is another improvement in communication facilities, residents are not willing to pay more. Five neighbourhood attributes significantly contributed to rental variation in Utako area, such that any additional number of street light significantly contribute 21.7% to rental variation; additional increase in the number of constructed cover-drainage significantly contribute 21.1% to rental variation, improved 24hours public water supply significantly contribute 31.1% to rental variation; additional facility to waste management significantly contributes 40.3% to rental variation; and additional construction of quality road by 1km significantly contribute 33.4% to rental variation. In Kubwa, six independent variables significantly contributed to rental changes in the study areas, such that additional increase in number of street light significantly contribute 26.5% change in rental

values, improve in number of covered drainage significantly contribute 16.5% change in rental value, improved in 24hrs supply of public water significantly contribute 33.1% change in rental values, any improved in communication network facilities significantly contribute 55.1% change in rental value. Any additional increase waste disposal facilities significantly contribute 30.1% change in rental value and additional increase in road construction by 1km significantly contributes 20.3% change in rental values. Five neighbourhood attributes significantly contributed to rental variation in Lugbe area, such that each additional increase in the number of street light significantly contribute 35.4% to rental variation; additional increase in the number constructed cover-drainage significantly contribute 24.1% to rental variation; Improved in 24hours public water supply significantly contribute 36.9% to rental variation; additional facility to waste management significantly contributes 14.6% to rental variation; and additional construction of quality road by 1km significantly contribute 34% to rental variation. The findings proved that neighbourhood attributes have significant contribution to rental changes in Abuja. It is proved that neighbourhood environmental attributes such as street light, public water communication facilities, waste disposal facility and road quality were major drivers of rental changes in Abuja and therefore regarded as indispensable attributes that must be considered by real estate investors and other real estate stakeholders.

Table 5: Hedonic Contribution of Neighbourhood Attributes on Rental Value

Model	Maitama Market (Coefficient)	Wuse market (coefficient)	Gwarinpa market (Coefficients)	Utako Market (Coefficient)	Kubwa Market (Coefficient)	Lugbe Market (Coefficient)
(Constant)	2.906** (.005)	1.949** (.014)	2.806** (.006)	3.684** (.000)	8.667** (.003)	3.175** (.004)
Security Patrol	.049 (.128)	.114** (.021)	.146 (.202)	-.034 (.324)	.021 (.312)	.037 (.230)
street light	.426** (.002)	.251** (.003)	.227** (.041)	.217** (.031)	.265** (.012)	.354** (.014)
drainage system	.164** (.042)	.119** (.044)	.265** (.021)	.211** (.037)	.165** (.024)	.241** (.013)
Public water supply	.231** (.043)	.214** (.026)	.232** (.018)	.311** (.024)	.331** (.028)	.369** (.015)
electricity supply	-.075 (.110)	.019 (.218)	.073 (.341)	.024 (.324)	.018 (.345)	.017 (.159)
communication facilities	.328** (.003)	.115 (.058)	-.027 (.234)	.043 (.356)	.515** (.038)	-.030 (.324)
waste disposal facility	.304** (.004)	.216** (.042)	.303** (.032)	.403** (.033)	.301** (.025)	.146** (.023)
Road quality	.580** (.002)	.351** (0.014)	.279** (.002)	.334** (.043)	.203** (.033)	.340** (.030)
R ²	.684	.701	.689	.716	.651	.603
f-ratio	12.342	10.587	9.430	11.876	13.760	10.435
p-value	.000	.000	.003	.000	.000	.000

Table 6 shows the contribution of natural attributes on rental value. The study revealed that 65.1%, 71.7%, 69.2%, 60.3%, 68.2% and 67.0% variation in rental value in Maitama, Wuse, Gwarinpa, Utako, Kubwa and Lugbe residential markets respectively which can be explained by independent variables(natural attributes) in the model. The result of F-tests across the study areas showed that the model is fit and significant. In Maitama, five natural attributes significantly contributed to rental variation in the study area, such that additional rise in noise level significantly decrease the rental values by 36.0%; any additional increase in dust level associated gas emission, industrial smoke and automobile carbon monoxide significantly decrease the rental value by 22.7%; continuous waste management to avoid natural water pollution significant increase rental values by 30.1%, continuous maintenance of green area to bring good oxygen and good aesthetics significantly increase the rental values by 12.5% and an average weather condition significantly increase rental value by 40.9%. In Wuse, five natural attributes significantly contributed to rental variation in the study area, such that additional rise in noise level significantly decrease the rental values by 25.9%; any additional increase in dust level associated gas emission, industrial smoke and automobile carbon monoxide significantly decrease the rental value by 22.9%; continuous waste management to avoid natural water pollution significant increase rental values by 25.6%, continuous maintenance of green area to bring good oxygen and good aesthetics significantly increase the rental values by 19.3% and an average weather condition significantly increase rental value by 30.9%. In Gwarinpa area, four natural attributes significantly determined the rental value, such that additional rise in noise level significantly decrease the rental values by 21.0%; any additional increase in dust level associated carbon emission, industrial smoke and automobile carbon monoxide significantly decrease the rental value by 35.0%; continuous waste management to avoid natural water pollution significant increase rental values by 46.2%, an average weather condition significantly increase rental value by 41.2%. In Utako

area, four natural attributes significantly determined the rental value, such that additional rise in noise level significantly decrease the rental values by 22.3%; any additional increase in dust level associated carbon emission, industrial smoke and automobile carbon monoxide significantly decrease the rental value by 25.0%; continuous waste management to avoid natural water pollution significant increase rental values by 26.2%, an average weather condition significantly increase rental value by 53.2%. Four natural attributes significantly determined the rental value in Kubwa area, such that additional rise in noise level significantly decrease the rental values by 47.2%; any additional increase in dust level associated carbon emission, industrial smoke and automobile carbon monoxide significantly decrease the rental value by 23.7%; continuous waste management to avoid natural water pollution significant increase rental values by 22.9%, the more additional open space created tends to contribute to rental value by 23.4% and an average weather condition significantly increase rental value by 48.4%. Also, four natural attributes significantly determined the rental value in Lugbe area, such that additional rise in noise level significantly decrease the rental values by 37.8%; any additional increase in dust level associated carbon emission, industrial smoke and automobile carbon monoxide significantly decrease the rental value by 42.3%; continuous waste management to avoid natural water pollution significant increase rental values by 32.2%, and an average weather condition significantly increase rental value by 23.1%. Two natural environmental attributes were found to have negative significance across the selected markets such as noise level and dust level. By implication, noise and dust level negatively contributed to rental changes across the market and real estate investors should take precaution against effect of noise and dust level in the location. Water quality and weather condition were found to have positive significant contribution to rental changes across the study area and should be given more attention by real estate investors with view to improving the value of real estate investment.

Table 6: Hedonic Contribution of Natural Environmental Attributes on Rental Value

Model	Maitama Market (Coefficient)	Wuse market (coefficients)	Gwarinpa market (Coefficients)	Utako Market (Coefficient s)	Kubwa Market (Coefficients)	Lugbe Market (Coefficient s)
(Constant)	2.832** (.000)	2.864** (.000)	1.770** (.012)	1.890** (.044)	9.067** (.000)	3.252** (.000)
noise level	-.360** (.000)	-.259** (.012)	-.210** (.023)	-.223** (.034)	-.472** (.000)	-.378** (.000)
level of dust	-.227** (.045)	-.229** (.032)	-.350** (.031)	-.250** (.035)	-.237** (.013)	-.423** (.000)
Natural water quality	.301** (.035)	.256** (.036)	.462** (.026)	.262** (.033)	.299** (.023)	.322** (.002)
Green area	.125**	.193**	.171	.191	.014	.053

	(.009)	(.033)	(.213)	(.053)	(.142)	(.452)
open space	.011	.021	.098	-.088	.234**	.005
	(.431)	(.639)	(.289)	(.156)	(.019)	(.512)
weather condition	.409**	.309**	.412**	.532**	.484**	.231**
	(.000)	(.000)	(.029)	(.001)	(.000)	(.037)
R ²	.651	.717	.692	.603	.682	.670
F-ratio	10.342	9.053	9.210	10.210	11.051	9.453
p-value	.000	.000	.000	.000	0.000	.000

Table 7 explains the contribution of structural attributes on rental value. It revealed that 75.1%, 69.7%, 70.2%, 65.7%, 66.8% and 72.1% variation in rental value in Maitama, Wuse, Gwarinpa, Utako, Kubwa and Lugbe residential markets respectively can be explained by independent variables (structural attributes) in the model. The result of F-tests across the study areas showed that the model is fit and significant. The significant variables that contributed to rental variation across the study areas are said to have explanatory power on dependent variables such that wall-fence around the residential building significantly contribute 12.4%, 14.4%, 21.8%, 22.8%, 46.0% and 18.3% to rental variation in Maitama, Wuse, Gwarinpa, Utako, Lugbe and Kubwa respectively. Burglary proof around the residential building significantly contribute 20.3%, 31.9%, 17.5% and 15.5% to rental value in Gwarinpa, Utako, Kubwa and Lugbe respectively. Roof quality in residential properties significantly contribute 18%, 28%, 44.1%, 29.7% and 66.5% to rental values in Maitama, Wuse, Gwarinpa, Utako, Kubwa and Lugbe respectively. Wall finishes in residential properties significantly contribute 20.7%, and 30.7% to rental values in Maitama and Wuse respectively. The quality

of floor significantly contribute 30.1%, 30.4%, 22.4%, 22.3% and 32.4% to rental values in Maitama, Wuse, Gwarinpa, Utako and Kubwa. Landscaping around residential properties significantly contribute 40.1%, 30.1%, 31.0%, 32.0%, 25.7% and 30.7% to rental value in Maitama, Wuse, Gwarinpa, Utako, Lugbe and Kubwa respectively. Any additional more room significantly contribute 21.5%, 24.9%, 27.8%, 27.4%, 21.1% and 47.9% to rental values in Maitama, Wuse, Gwarinpa, Utako, Kubwa and Lugbe respectively. Additional increase in number of toilet significantly contributes 52.5% to rental value in Lugbe. Addition number of bathroom significantly contributes 19.9%, 17.9%, 28.6% and 95.4% to rental value in Maitama, Wuse, Utako, Kubwa and Lugbe. Thus, an increase in any of the structural attributes is likely to increase the house rents. Among the structural attributes, wall quality contributed more significantly to the rising house rents than any other attributes. Findings from the contribution of structural environmental attributes proved that quality of wall fence, roof quality and size of bedroom were found significant across the selected study areas and thereby they are considered indispensable in rental determination.

Table 7: Hedonic Contribution of Structural Attributes on Rental Value

Model	Maitama Market (Coefficient)	Wuse market (coefficients)	Gwarinpa market (Coefficients)	Utako Market (Coefficients)	Kubwa Market (Coefficient s)	Lugbe Market (Coefficient s)
(Constant)	4.773** (.003)	3.423** (.001)	5.109** (.000)	2.034** (.003)	8.152** (.000)	7.615** (.002)
quality of fence	.124** (.021)	.144** (.021)	.218** (.037)	.228** (.031)	.460** (.000)	.183** (.024)
Burglary proof	.013 (.231)	-.113 (.131)	.203** (.045)	.319** (.002)	.175** (.000)	.157** (.031)
quality of roofing	.180** (.023)	.280** (.003)	.108 (.064)	.441** (.001)	.279** (.000)	.665** (.000)
Quality of wall finishes	.207** (.025)	.307** (.032)	.013 (.214)	.122 (.056)	.014 (.452)	.044 (.321)
quality of floor	.301** (.029)	.304** (.001)	.224** (.034)	.223** (.021)	.324** (.000)	.052 (.412)
Landscape	.401** (.000)	.301** (.002)	.310** (.031)	.320** (.018)	.257** (.000)	.307** (.013)
Bedroom	.215** (.019)	.249** (.034)	.278** (.012)	.274** (.029)	.211** (.041)	.479** (.000)
Toilet	.105 (.062)	.021 (.401)	.119 (.312)	.124 (.120)	-.023 (.439)	.525** (.001)
Bathroom	.199** (.043)	.179** (.041)	.092 (.324)	.286** (.037)	.954** (.000)	.052 (.416)

R ²	.751	.697	.702	.657	.668	.721
F-ratio	13.023	9.034	12.098	10.997	12.034	9.230
P-value	.000	.000	.000	.000	.000	.000

Table 8 presents the result of mixed regression of hedonic contribution of the environmental attributes on rental value. The study revealed that the overall 70.1% significant variation in rental value across the study areas can be explained by environmental attributes under consideration while the remaining 29.9% unaccounted variables are associated with other factors that are not considered in the model. The model is considered fit for the purpose of prediction as p-value of F-statistic (10.765) is statistically significant ($0.000 < 0.05$), and the model can therefore be used for predicting rental variation in residential market, this finding is consistent with that of Cellmer *et al.*, (2012). Also fifteen attributes had significant explanatory power in explaining rental variation in residential market, such that street light in the area significantly contributed about 29.8% to rental value in the areas. Water supply

to residential property contributed about 34.6% of the rental values in the area, this finding is consistent with that of McClauskey *et al.* 2008 and Nikolaos *et al* 2011. Road quality, burglary proof, wall quality, floor quality, landscaping, unit of bedroom, toilet, and bathroom significantly contributed 23.3%, 29.6% 53.0%, 32.8%, 31.6% 46.1% 26.0% and 43.3% of the rental value respectively. Noise level and dust level were found negative to rental values such that high level noise due to business activities negatively reduce the rent by 43.5%, and high level of dust due to emission of carbon negatively reduce the rent by 13.7%, this finding is consistent with that of (Samy, 2015; Nicholls & Crompton, 2018). Quality of natural underground water contributed about 26.0% of the rent and an average weather condition in the area contributed 49.4% to rental values.

Table 8: Mixed Regression Result of Hedonic Contribution of Environmental Attributes

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics		R ²	F	Sig.
	B	Std. Error	Beta			Tolerance	VIF			
(Constant)	7.650	3.043		2.514	.013			.701	10.765	.000
Security Patrol	.142	.217	.116	.656	.513	.723	1.383			
street light	.298	.181	.310	1.642	.022	.677	1.477			
functionality of Street light	.066	.064	.090	1.031	.304	.667	1.499			
drainage system	.354	.192	.338	1.845	.067	.601	1.663			
water supply	.346	.296	.031	1.168	.007	.678	1.474			
electricity supply	.422	.276	.346	1.527	.128	.675	1.481			
communication facilities	.037	.199	.031	.185	.854	.873	1.145			
waste disposal facility	.108	.084	.138	1.277	.203	.611	1.636			
Road quality	.233	.217	.196	1.071	.026	.799	1.251			
quality of fence	.205	.541	.139	.379	.705	.567	1.763			
Burglary proof	.296	.283	.048	1.046	.043	.673	1.486			
Quality of wall finishes	.530	.396	.102	1.339	.035	.854	1.171			
quality of floor	.328	.350	.241	.936	.021	.774	1.291			
Landscape	.316	.306	.009	1.034	.038	.745	1.342			
quality of electrical fittings	.276	.499	.197	.552	.281	.902	1.108			
Bedroom	.461	.483	.040	.955	.003	.801	1.248			
Toilet	.260	1.178	.235	.220	.034	.791	1.264			
Bathroom	.433	.301	.373	1.440	.028	.856	1.168			
noise level	-.435	.312	-.462	-1.397	.004	.785	1.274			
level of dust	-.137	.361	-.164	-.379	.045	.649	1.541			
Landscaping	.116	.087	.129	1.328	.186	.599	1.669			
availability of green area	.038	.164	.037	.233	.816	.654	1.529			
open space	.067	.179	.070	.373	.709	.902	1.108			
quality of natural water	.260	.233	.021	1.116	.048	.654	1.529			
weather condition	.294	.277	.495	1.784	.006	.880	1.136			

CONCLUSION

Hedonic model revealed the contribution of each environmental attributes on rental value. It is observed from the results across the study areas that the structural attributes (like, quality of fence, burglary proof, wall quality, floor quality, landscaping, unit of bedroom, toilet and bathroom) of the residential houses have strong statistical significance for the amount of house rents charged by house owners. The study found that 70.1% significant variation in rental values across the selected areas in Abuja can be explained by the level of environmental quality attributes under consideration while the remaining 29.9% were unaccounted variables that are associated with other factors that were not considered in the model. The model is considered fit for the purpose of prediction as p-value of F-statistic (10.765) is statistically significant ($0.000 < 0.05$), and the model can therefore be used for predicting rental variation in residential market. Also fifteen attributes had significant explanatory power in explaining rental variation in the market. Therefore, the value of environmental amenity should be captured in the price of residential properties close to it. The study revealed the relative importance of each of the environmental attributes in the rental values of residential properties. It is observed from the results across the study areas that the structural attributes (like, quality of fence, burglary proof, wall quality, floor quality, landscaping, unit of bedroom, toilet and bathroom) of the residential houses have strong statistical significance for the amount of house rents charged by house owners. It is therefore recommended that every individual should not only strive to get accommodated but also search for locations that deliver a high quality. It is equally important that government pay attention to the structural, locational and neighbourhood attributes of residential dwellings as people place more premiums on such attributes.

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