Willingness to Pay for Sustainable Features in Prime Residential Submarkets of Lagos

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Abstract  
In this study, I examine the market potential for various sustainable features by residents in Lagos prime residential submarket in the context of their willingness to pay (stated and revealed preferences) for green features. The study is of great significance as Nigeria is likely to produce a green building policy and certification standard in the near future through the Green Buildings Council of Nigeria. Data were obtained through the distribution of 150 questionnaires to households and evidence of lettings in Ikoyi and Victoria Island, the two prime residential neighborhoods in Lagos. The findings show that occupiers are willing to pay for sustainable features. The findings also indicate that poor electricity provision, dark staircases, and poor indoor air quality have a negative effect on rental price.

Keywords  
energy efficiency, green features, submarket, WTP, willingness to pay

Real estate is a composite commodity comprised of different attributes. The implicit price of each of these attributes constitutes the value of real estate (Rosen, 1974). Monsoon (2009) stated that buildings can be compared to a bundle of goods sold in the market where each of the building characteristics combined equates to the expected overall transaction price. When a building has green attributes, these attributes together with other attributes (non-sustainable features) will be the determinant of the value of the building (real estate). These attributes are what create utility and demand for real estate. Many studies find that housing price depends on housing qualities and environmental characteristics (Tyrväinen and Väänänen, 1998; Thériault, Des Rosiers, Villeneuve, and Kestens, 2003; Chan, Yiu, Baldwin, and Lee, 2009). Real estate developers provide a number of different housing products in the market and simultaneously bear the cost of development. However, buyers pay a premium for those products based on their level of demand and willingness to pay (Zhang and Dong, 2018). Rational investors must therefore consider user preferences for various building attributes and their willingness to pay to establish demand. The aim of property development and redevelopment is to satisfy the societal needs and property developers respond by supplying the type of property demanded in the various market segments (Shilling, 2002; Edensor and Millington, 2009).
Real estate demand can be defined generally as the quantity of a particular type of real estate product or service that will be purchased or leased, in a given market. The demand for real estate is determined by its productivity (Smith and Corgel, 1992; Fanning, 2005). Property productivity analysis and market segment analysis identify the physical, locational, legal, and design/amenity attributes of the subject property. These qualities of the property account for its utility and productivity. These are based on the following questions: (1) What demand is there for the attributes? (2) How will the productivity attributes (green attributes) of the particular property attract users to the real estate? (3) How many people can afford to pay for the attributes of the particular property? (4) How much are they willing to pay for these attributes? (Fanning, 2005).

This study is about the willingness to pay (WTP) for green features in two prime residential neighborhoods in Lagos. The Nigerian government is yet to produce a green policy or certification standards. However, stakeholders in the construction industry have been advocating the importance of embracing the green movement in Nigeria. Thus, it is important that investors are assured that prospective tenants are desirous and willing to pay for green features when provided in new development/re-development or through retrofitting. There is also a need to be proactive and provide incentives for developers and real estate investors to venture into the developments with green features.

There is a significant distinction between stated and revealed WTP. The revealed WTP is based on observed behavior and transaction prices while the stated WTP is based on intended choices and stimulated markets are used to elicit WTP based on responses collected through surveys or interviews (Field and Field, 2002; Perman, Ma, McGilvary, and Common, 2003; Kwak, Yoo, and Kwak, 2010; Brounen and Kok, 2011; Mendell and Wilhelmsson, 2011). In this paper, I adopt both stated or expressed WTP and revealed WTP. With respect to the latter, the hedonic price model is adopted, while for the expressed WTP, the contingent valuation method is adopted. The use of both methods is to address some of the challenges in the use of the contingent valuation model (CVM) (Diamond and Hausman, 1994; Hausman, 2012). Zalejska-Johnson (2014) used both methods to study WTP for green buildings in Sweden.

There are few studies on the WTP for sustainable features in real estate in the Nigerian property market. This study adds to this literature. In most third-world countries like Nigeria, there is the problem of awareness and this is a major constraint to participation in the global green movement. Residential green building developers and home builders have traditionally entered markets with little concrete information and understanding of the true nature of consumer demand for green homes (Martin, Swett, and Wein, 2007). In Nigeria, green buildings are beginning to enter the market. Currently, there are only three LEED certified buildings in Lagos and all are high-rise office buildings. There is a need to involve all relevant stakeholders in green building for a successful outcome. According to Martin, Swett, and Wein (2007), a building market is most ripe for increases in green building when numerous stakeholders are all pushing for these increases. The three primary elements critical for green housing markets are: (1) consumers, (2) industry (both for profit and non-profit organizations), and (3)
government. In a perfectly robust green housing market, there would be a large number of home buyers who are well vested in the attributes of green homes, receptive to the green housing value proposition, and discerning of the many possible green housing products available. In Nigeria, the green concept, sustainability, and environmental issues are barely considered when designing a new building or renovating an old one. This results in a short fall in user satisfaction, functional space planning, and service types. In addition, sustainable building components are rarely considered during design and construction (Otegbulu, 2011). Climate change has triggered extreme weather conditions in Nigeria, and this calls for urgent attention to green features integration in new construction or through retrofitting.

This is based on both stated and revealed WTP for 17 green features by residential households. The contingent valuation method (CVM) is a versatile and often the adopted technique or model for attributes that are not directly traded in the market place. It has been used by various researchers. Fukahori and Kubota (2003) applied CVM to study the WTP for street improvement, Chan, Yin, Baldwin, and Lee (2009) used CVM to determine the value of health feature in buildings, Tyrvainen and Vaananen (1998) praised the CVM technique for its simplicity and directness in assessing amenity values of an urban forest, and Robinson, Simons, Lee, and Kern (2016) used the CVM to determine the WTP for green features in office buildings. The CVM is particularly relevant for this study on green features because many of these attributes (features) are not traded individually in the property market. It enables assessment by creating hypothetical markets. It is used to examine individual WTP for the utility derived from a particular good. With regard to this study, the use of WTP is of particular importance to determine occupiers/tenant preferences for individual green features as the rent paid does not disaggregate tenants’ value perception of the green components. This is reinforced and corroborated with hedonic pricing to determine the hedonic contribution of sustainable features on residential property value from a quantitative point of view. Hedonic regression is frequently used in real estate economics to establish consumers’ WTP for given features (De Ruggiero, Forestiero, Maganelli, and Salvo, 2017). This analytical technique allows appraisers, investors, and policy makers to appreciate and understand the value of otherwise hard to quantify property features. This methodology (HPM) deploys econometric techniques to identify the impact of building characteristics on value and can be used to identify the impact of green investments on building value (De Ruggiero, Forestiero, Maganelli, and Salvo, 2017). Hedonic pricing has been used by many researchers to determine the impact of green features on property prices (e.g., Dermisi, 2009; Chegut, Eichholtz, Kok, and Quigley, 2010; Newell, MacFarlane, and Walker, 2014; Yan 2015; Oyedokun, 2017).

Under CVM, survey respondents are asked to express their WTP for different green features. According to Abuamer and Boolaky (2015), proliferating green construction will only be viable when the property is received positively by the end users. This requires increased awareness creation on the importance of green features in terms of cost saving and being eco-friendly. The WTP result is also a good indicator for architects and developers to design for the provision of green
features in housing developments in the future (Chan, Yin, Baldwin, and Lee, 2009) as there is no green residential housing in Nigeria. The three LEED-certified commercial office buildings in Nigeria are Heritage Place (built by AVIS) with 65% occupancy, the Wings (built by RMB West Port) with 75% occupancy, and the NESTOIL Building (built by NESTOIL PLC); the level of occupancy is not available for these properties. The rent is $700–$800 per square meter. There is a perception by prospective tenants that they are more expensive than non-sustainable buildings. Prospective tenants have to be given a lot of explanation and a cost-benefit analysis to convince them that tenancy in these buildings is cheaper in the long run.

The study area is at the upper end of Lagos residential property market. Some of the buildings have high quality features to justify the high rent, but these features were not strategically provided to achieve sustainability. In this study, I attempt to solicit occupier’s preferences with respect to sustainable features and their WTP for them. Although the initial adoption of green buildings has been more prominent in the big cities of developed countries, interest has continued to grow among stakeholders in developing countries (UN-HABITAT, 2010). There is now a record demand for green buildings globally due to performance against the triple bottom line of sustainability (Oyedokun, 2017). This demand is triggered more due to global warming and high energy costs.

The aim of the study is to determine household WTP (expressed and revealed) for green features in the study area with a view to establishing a basis for real estate investors and developers to invest in buildings with sustainable features. The objectives of study include: condition of the building components/services, level of awareness, level of energy efficiency practice, the influence of green features on rental value, factors that will influence rental value, average rental value in the study area, WTP for green features, and contribution of green features to rental value. The outcomes of the study will provide information to guide future investors in green building of tenant’s priorities with regards to green features.

The Study Area

The study area is Ikoyi and Victoria Island neighborhoods of Lagos. Both are prime residential neighborhoods. See Exhibit 1.

Ikoyi

Ikoyi is the most affluent neighborhood in Lagos, and is located on Lagos Island. It is northeast of Obalende, encompasses the eastern half of Lagos Island, and lies at the edge of the Lagos lagoon. It is populated by the upper class residents of the city.

The area that makes up Ikoyi was originally part of Lagos Island until it was separated from Lagos Island by a narrow waterway that was dug by the British colonial government. This canal has now been built over or filled up so that the two islands are fused together again. It is shielded from the Atlantic Ocean by Victoria Island and the broad sand spits running east down the coast.
During the colonial era, the island was developed as a residential cantonment for the expatriate British community and still retains many of the large colonial residences built between 1900 and 1950. Upmarket residential properties continued to be built after the colonial period. The Dodan Barracks became the residence of some of Nigeria’s military rulers. Ikoyi now contains many other government buildings, as well as business, hotels, schools, and the famous social club. Ikoyi Club built in 1938 and the Ikoyi Club Golf Course are in the area.

One of the main attractions in Ikoyi is Awolowo Road, which is a street lined with upscale shops and boutiques. Due to its proximity to Victoria Island and Lagos Island, much of Lagos business tourism is centered in Ikoyi, which has a mix of excellent four-star hotels and upscale office developments. Ikoyi also includes the newer suburbs of Banana Island, Parkview Estate, and Dolphin Estate.

**Victoria Island**

Victoria Island is an affluent neighborhood that encompasses a former island of the same name that sits between Lagos Island and the Lekki Peninsula in the Lagos Lagoon. It is the main business and financial center of Lagos. Victoria Island is one of the most exclusive and expensive areas to live in Nigeria. Victoria Island is bordered by the Atlantic Ocean on the South, the mouth of the Lagos Lagoon on the west, the Five Cowrie Creek to the north, and swamps on the east. The cost of renting an apartment with luxurious amenities ranges from $48,000...
Rents for flats and other accommodation in the study area are about the highest in Africa, ranging from 6 million to 20 million naira.

**Literature Review**

**Green Building Defined**

According to the U.S. Green Building Council (USGBC), a green building is one that has been designed, constructed, and operated to offer higher environmental, health, economic, and productivity performance over that of conventional buildings (Simmons, 2010). In other words, it involves the creation of structures and the processes that are environmentally friendly and resource-efficient throughout the building’s life cycle.

**Benefits of Green Buildings**

Energy efficiency and renewable energy are the major focus in most green building. Green building focuses on increasing the efficiency of resource use such as energy, water, and materials while reducing the impact on human health and the environment during the buildings life cycle, through better siting, design, construction, operation, maintenance, and human behavior. Green or sustainable buildings are characterized by the following basic features: demand for a safe and healthy building, flexibility, market and economic value, neutralization of environmental impact in the context of human wellbeing, and occupants’ satisfaction (Otegbulu, 2011; Midha, Midha, and Mathu, 2013; Abuamer and Boolakey, 2015). Energy efficiency is very critical to the economy of Nigeria as it has a palliative effect on the energy deficit. According to the USGBC, buildings in the U.S. account for approximately 37% of the country’s energy use and 68% of the country’s electricity use, along with 12% of the fresh water supply, 88% of portable water supply (water fit for human consumption), and 40% of the country’s raw materials. The buildings collectively generate about 30% of municipal solid waste and 30% of total emission of carbon dioxide. Green buildings can stimulate the economy at a level one and a half times more than the U.S. federal stimulus bill. In terms of climate change and energy efficiency, it would be the equivalent of taking more than 200 million vehicles off the road (Simmons, 2010). In Nigeria, which has serious environmental energy and water infrastructure problems, there is a need for enforcement of green certification in both residential and commercial buildings.

The main goal of green design is sustainable development, which is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The Brundtland report’s concept of sustainability allows us to avoid the true dangers implicit in the world’s population growth and increasing standard of living. According to Hendrickson et al. (undated), there are three general goals for green design in pursuit of a sustainable future: (1) to reduce or minimize the use of non-renewable resources; (2) manage
renewable resources to ensure sustainability; and (3) reduce, with the ultimate goal of eliminating toxic and otherwise harmful emission to the environment, including emissions contributing to global warming.

The objective of green design is to pursue these goals in the most cost-effective fashion. Green building technology and construction is relatively new and there is a global need to increase the awareness of its importance to consumers in both developed and emerging economies. At the international level, the World Green Building Council (WGBC) was only established in 1999. This body and other related regional bodies mainly focus on providing buildings that are environmentally responsible, economically viable, and promote a healthy environment. According to Aroul and Rodriguez (2017), there has been growing concern regarding the environment, resulting in increasing consumer demand for more environmentally friendly options. In addition, many individuals have started to focus on the environmental impact of their homes. Also due to the increased awareness of the economic benefits as well as the non-financial benefits of energy efficiency, green features have become a more prominent aspect in home purchase decisions. The benefits of sustainable design to all developing countries are enormous. Sustainable waste management will help in securing and sustaining a healthy environment to help avoid epidemics in light of the poor state of many health facilities. It will also encourage water conservation and promote healthy indoor air quality, which enhances good health and productivity. It addition, it will reduce operational costs in terms of service charge payments and promote competitiveness in the housing market.

**Dimension of Green Designs (Green Features)**

According to Engel-Yan, Kennedy, Saiz, and Pressnail (2005) and Otegbulu (2011), the dimensions of green design include energy efficiency, water efficiency, waste reduction, building operation, construction, maintenance and maintainability, occupant health and productivity, storm water management, and climate and environmental integration (sustainable neighborhood). The list is not exhaustive, but it is important to note that green building features or characteristics overlap with many other neighborhood elements like installation of water conserving features, recovery of non-sewage wastewater and the use of pervious paving around buildings. Generally, it saves operational costs through the integration of efficient design and building features. Embracing green or sustainable concepts in design is aimed at reducing energy, operation and maintenance costs, reducing building related illness, increasing the productivity and comfort of building occupants, reducing waste and pollution, and increasing building component durability and flexibility. It is important that the green concept be embraced from the early stages of building design, planning, and construction. According to Gottfried (1996), the decisions made at the first phase of building design can significantly affect the costs and efficiencies of other phases, as recent studies have shown that green building measures taken during construction or renovation can result in significant building operational savings, as well as increase employee productivity. Reducing operational costs will also reduce occupant costs and increase net income for investors.
Need to Create Awareness of the Importance of Green Building Features

Climate change and sustainability issues have garnered increased attention globally. Since the United Nations framework convention on climate change (2007) brought the issue to the attention of governments. Consequently, in the past few years, more stringent environmental laws and soaring energy prices have increased the need for the real estate industry to participate in energy reduction and housing sustainability through efficient house construction and design, as well as upgrading the existing housing stock to be more energy efficient and environmentally suitable. This environmental sustainability practice relates to the maximization of energy efficiency for specific housing markets and local weather conditions (Eves and Kippes, 2010). The problems associated with climate change constitute a formidable threat to global environmental sustainability. In addition, the building industry uses a substantial amount of resources, and accordingly, has a large impact on the environment (Qian and Chan, 2010). In Nigeria, the government’s policy on sustainability seems unclear and is not communicated to the citizenry. One thing is certain, there are no local sustainability standards nor are there any incentives for investors in property development to embrace sustainability. Currently, a number of internationally recognized assessment systems, such as Leadership in Energy and Environmental Design (LEED) in the U.S., the BRE Environmental Assessment Method (BREEAM) in the U.K., the Hong Kong Building Environmental Assessment Method (HK-BEAM), and the Energy Guide in Canada, have attempted to develop objective BEE standards (Qian and Chan 2010). Many developed countries have set up good examples to promote the need to integrate green features into buildings and Nigeria would do well to draw from these examples. There is need for a standard to measure compliance; this is to be executed through a well-equipped and funded regulatory body that will ensure strict implementation of sustainable policies. Creating awareness to all stakeholders is critical to the successful implementation of any sustainable policy. This could be better achieved by making citizens understand the enormous benefits associated with sustainable features.

Consumer Preferences and Willingness-to-Pay

Consumer preferences and willingness-to-pay are options that have the greatest anticipated value among a number of options. The average consumer is a fairly rational person and attempts to dispose of income in such a way as to derive the greatest amount of satisfaction or utility from it. This does not imply that this individual is able to achieve the maximum amount of utility from this income. For example, inadequate knowledge of the available goods could constrain utility maximization. Typically, the average consumer has clear-cut preferences for various goods and services, and buyers have a good idea of how much marginal utility they will get from various products (McConnel, 1978; Samuelson and Nordhaus, 2005). WTP is an extension of consumer or user preference, and a variant of contingent valuation.
Contingent valuation (CV) is a well-known approach to measure a consumer’s stated preferences for a good, service or policy (Carson and Hanemann, 2005). CV estimates an individual’s WTP for a good or policy, such as a change in an environmental amenity, using survey questions that solicit information on how much the individual would be willing to pay to have the good or policy implemented (William, Morey, and Lodder, 1998). A lot of studies on the demand for green features have been carried out using WTP (Simons, 2014; Zalejska-Jonson, 2014; Robinson and McAllister, 2015; Robinson, Simons, Lee, and Kern, 2016). It is important to identify tenants’ preferences for specific green features as a guide to investment decisions and policy making.

Contingent Valuation Model

The term “contingent valuation” is based on the characteristics feature of this method as it works on asking people to state their WTP contingent on a specific hypothetical scenario and description of the environmental goods and services (Breedlove, 1991; Mishra, 1998). It asks people to provide the maximum or minimum amount they would pay for an environmental amenity. The responses to the question then represent the value of the environmental change (Freeman, Herriges, and Kling, 1993).

The essential elements of the survey include descriptions of environmental goods that are to be valued, descriptions of the payment vehicle, and descriptions of the hypothetical market. Descriptions of the natural goods include all the valuable attributes of the good. The payment vehicle pertains to how the money will be paid. One can pay for a good in cash when it is used or by means of increased income tax. The description of the hypothetical market should include an identification of those who will provide and those who will pay for the environmental improvement. It should be made clear that the payment is a collective action. Everybody else will also pay, otherwise the respondents may refuse to pay, although they may appreciate the good (Mitchell and Carson, 1989; Freeman, Herriges, and Kling, 1993; Hoevenagel, 1994; Desvousges, Johnson, and Benzhaf, 1998; Mishra, 1998). A diverse group of economic and real estate journals have publications using stated WTP. Simons and Winson-Geidemann (2005) have used contingent valuation to estimate real estate value related to environmental contamination, Robinson, Simons, Lee, and Kern (2016) used the method of rental premium estimates widely called the contingent valuation (CV) method, which has been generally accepted for over 30 years. The authors analyzed the demand for green office building features among office tenants in the U.S. They found the highest WTP for improved indoor air quality and access to natural light. The results showed that public firms, along with those in the energy and information technology industries are most likely to pay for green labeled buildings. The findings provide implications for policy makers and property developers in terms of which building features are considered to be the most important for green building practices, and how the demand for green features potentially differs across regions.

Brookshire, Thayer, Schulze, and D’arge (1982) confirmed the validity of environmental amenity survey methods as a means of determining the value of
public goods, through their analysis of real estate values. They employ CV to estimate an individual’s WTP for a good, service or policy. Chan et al. (2009) study the value of healthy building parameters using the contingent valuation method (CVM), which gives a direct appraisal of an occupant’s values. The results suggest that most residents are willing to pay for healthy building parameters. The results also suggest that there is a value hierarchy in the WTP for specific attributes. If developers are aware of the approximate amount people are willing to pay for specific building attributes, this is evidence of the importance of a green amenity and the level of utility attached to it. This will also provide a basic cost-benefit evaluation during project design and help with the cost estimation of the project. It will also encourage and facilitate the inclusion of green features in future designs, particularly in third world countries like Nigeria where there are no green standards. These are good incentives for the sustainability or inclusion of green features during project design and for the development of relevant government policies.

**Revealed Willingness-to-Pay/Hedonic Price Model**

The hedonic price model is a variant of revealed WTP. It is based on observed behavior, thus uses transaction prices (Brounen and Kok, 2011). The hedonic price model (HPM) derives from the characteristics theory of value and was first proposed by Lancaster (1966) and Rosen (1974). This HPM is used to evaluate the value of a commodity as a bundle of valuable characteristics, where one or more of the characteristics may be environmental. Thus, the value of a house depends on its structural, locational, and neighborhood attributes. The HPM was first applied to environmental valuation by Ridker and Henning (1967). There are three stages in the HPM: (1) a hedonic function is estimated; (2) implicit prices are calculated for the environmental variable of interest; and (3) a demand curve for this variable may be estimated. It is an indirect method and also an aspect of revealed WTP. A lot of studies have quantified the effect of green buildings on housing prices using HPM; De Ruggiero, Forestiero, Maganelli, and Salvo (2017) use the HPM to evaluate how certain energy features impact the value of buildings. They find that energy performance contributes to the market value of buildings. Chegut, Eichholtz, Kok, and Quigley (2010) study the value of green buildings in the U.K. Their results reveal that a building’s green characteristics have a positive impact on sales and rental transaction prices of 8% and 16%–20%, respectively, depending on the model’s specification. Yau (2015) uses the HPM to examine the effect of green building safety in Hong Kong. The major aim of the study was to determine how the safety performance of a building is valued by the property market. The findings show that buildings that have a poor safety performance and more unauthorized appendages sold at a discount while buildings with good safety performance sold at a higher price. This study is very important as there are a lot of unsafe buildings in Nigeria. Building safety, however, has many dimensions—ranging from structural to environmental. There are old lifts in some buildings in Nigeria, which often trap users during a power failure, which happens frequently.
In addition, some lift doors are also not sensitive to objects and could cause injury to passengers.

Zhang and Dong (2018) examine housing and neighborhood characteristics in Beijing and find that most of the housing and neighborhood features have a positive impact on housing prices. They also find that one green attribute (green coverage) within the residential area increases the housing price by 1%. Feige, Mcallister, and Wallbaum (2013) use the HPM to examine the financial effects of sustainable construction in Switzerland. They find that energy/water efficiency, a healthy indoor environment, and building safety and security all have significant positive price effects.

Oyedokun (2017) investigates the impact of a green premium as a driver of investment in green buildings. The findings show that buildings with a green premium have a positive impact on building prices. The findings also show that green buildings are quite unique and are priced differently from non-green labeled buildings even when the latter are designed with high specifications. By implication, the inclusion of green features in buildings is not an alternative to green certification. Most countries in Africa including Nigeria have not yet introduced green certification. South Africa is an exception in this regard. Oyedokun’s (2017) findings strongly suggest the need for developing countries to embrace the green movement by introducing green certification in their real estate markets.

**Methodology**

The study is based on both expressed and revealed WTP for green features in the prime residential neighborhood of Ikoyi and Victoria Island. Both areas are selected as case studies because it is believed that they are in better positions to appreciate and pay for green features in all dimensions. In addition, because of the perceived high cost of buildings with green features, investors will likely want to invest in an area where they have the likelihood of recovering costs. The level of energy consumption is quite high, thus is a major item in a service charge budget. The study concentrates on blocks of flats within the study areas.

High-rise blocks of flats constitute 72.7% of the sample and low-rise blocks of flats constitute 27.3%. Survey respondents were heads and spouses of households in the study area. Using a sample of 150 households, structured questionnaires were distributed of which 120 were returned while 92 were found useful for analysis. Stratified random sampling was used in picking the buildings. Due to the high land value in the study areas, developers try to intensify their developments by building high-rise blocks of flats. For this reason, there are more high-rise buildings than low-rise in the sample. For every two high-rise building selected randomly, one low-rise was selected. From each building, I randomly selected one tenant per floor or every two floors depending on the number of floors. The questions were focused on a tenant’s awareness of green buildings, condition of building components/services, level of energy efficiency practice, influence of green features on rental value, and WTP for green features. The study
was based on both expressed and revealed WTP because the CVM is a versatile and often the adopted technique or model for attributes that are not directly traded in the marketplace and has been used by many researchers in similar studies (e.g., Chan, Queena, and Lam, 2009; Robinson, Simons, Lee, and Andrew, 2016). While a variant of revealed WTP, the hedonic price model is also used to quantify the effect of green features on rental price in the study area to provide an incentive to architects, investors, and policy makers.

The findings from the study using CV and revealed WTP (HPM) are also compared to provide a more robust analysis. The revealed WTP is based on actual rental transactions in Ikoyi and Victoria Island as the dependent variables. The independent variables are the 19 green features, income of respondents, and factors affecting tenants/occupiers comfort in the study areas. Information was obtained on 30 letting transactions of luxury flats in the study areas for the regression analysis. I also surveyed rental trends in the study area. This is done to cross-check whether the WTP is linked to the rental trend in study areas. It should also be noted that some respondents skipped some questions, which affected the uniformity in the total response.

**Results**

The findings are based on data collected from the structured questionnaire, as well as rental evidence from 30 rental transaction prices obtained from the estate surveyors in the study areas. Analysis of the rental transactions indicated an average rental price of ₦11,860,473. The results also show that 50 (54.3%) of the respondents are aware of sustainability while only 20 (21.7%) are aware of their benefits. Others 42 (45.7%) are not aware of green buildings. This implies that more of the respondents are not aware of the benefits of sustainable features.

Household income results revealed that 5 (5.43%) earn ₦1,000,000.00–₦2,000,000.00, 6 (6.52%) ₦2,000,000.00–₦4,000,000.00, 15 (16.3%) ₦4,000,000–₦6,000,000.00, 16 (17.39%) ₦6,000,000.00–₦10,000,000.00, 20 (21.74%) ₦10,000,000.00–₦16,000,000.00, and 30 (32.61%) earn above ₦16,000,000. The residents are all within the high-income bracket in Nigeria.

Exhibit 2 shows the rental trends and the percentage changes for 2012–2017. In most of the house types, there is rental growth from 2012 to 2015. Decline begins in 2016 due to an economic recession in the country. Looking at the fluctuating exchange rate, it is doubtful whether there is rental growth in real terms. The official exchange rate of naira to the U.S dollar for the years are as follows; 2012: ₦155.09 (₦161.5), 2013: ₦153.21 (₦162.9), 2015: ₦199 (₦300), 2016: ₦300 (₦370), and 2017: ₦360 (₦390). The figures in parentheses are the unofficial or black market rates.

**Elevators**

There were 44 respondents who indicated there was an elevator in their apartment. The condition of the elevators as supplied by the respondents is depicted in Exhibit
### Exhibit 2 | Rental Trend in Cameroon Road: Ikoyi

<table>
<thead>
<tr>
<th>Year</th>
<th>2 Bedroom</th>
<th>% Change</th>
<th>3 Bedroom</th>
<th>% Change</th>
<th>Detached House</th>
<th>% Change</th>
<th>Semi-Detached House</th>
<th>% Change</th>
<th>Terrace House</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>11,750,000</td>
<td>—</td>
<td>12,800,000</td>
<td>—</td>
<td>15,200,000</td>
<td>—</td>
<td>14,500,000</td>
<td>—</td>
<td>14,800,000</td>
<td>—</td>
</tr>
<tr>
<td>2013</td>
<td>11,750,000</td>
<td>0%</td>
<td>13,250,000</td>
<td>3.5%</td>
<td>15,200,000</td>
<td>0%</td>
<td>14,500,000</td>
<td>0%</td>
<td>15,000,000</td>
<td>1.35%</td>
</tr>
<tr>
<td>2014</td>
<td>12,000,000</td>
<td>2.13%</td>
<td>13,250,000</td>
<td>0%</td>
<td>16,000,000</td>
<td>5.26%</td>
<td>15,750,000</td>
<td>6.2%</td>
<td>15,000,000</td>
<td>0%</td>
</tr>
<tr>
<td>2015</td>
<td>12,000,000</td>
<td>0%</td>
<td>14,000,000</td>
<td>5.66%</td>
<td>16,000,000</td>
<td>0%</td>
<td>15,750,000</td>
<td>0%</td>
<td>15,200,000</td>
<td>1.33%</td>
</tr>
<tr>
<td>2016</td>
<td>12,500,000</td>
<td>4.16%</td>
<td>14,000,000</td>
<td>0%</td>
<td>15,500,000</td>
<td>3.12%</td>
<td>14,700,000</td>
<td>6.67%</td>
<td>14,700,000</td>
<td>3.29%</td>
</tr>
<tr>
<td>2017</td>
<td>12,250,000</td>
<td>−2%</td>
<td>13,500,000</td>
<td>−3.57%</td>
<td>15,500,000</td>
<td>0%</td>
<td>14,700,000</td>
<td>0%</td>
<td>14,700,000</td>
<td>0%</td>
</tr>
</tbody>
</table>
Exhibit 3 | Condition of the Elevator

Exhibit 4 | Staircase Type / Condition

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide and gently sloped</td>
<td>40 (51.3)</td>
<td>38 (48.7)</td>
</tr>
<tr>
<td>Well illuminated</td>
<td>27 (34.6)</td>
<td>51 (65.4)</td>
</tr>
<tr>
<td>Well kept</td>
<td>25 (32.1)</td>
<td>53 (67.9)</td>
</tr>
<tr>
<td>Narrow and gently sloped</td>
<td>14 (17.9)</td>
<td>64 (82.1)</td>
</tr>
<tr>
<td>Naturally illuminated</td>
<td>8 (10.3)</td>
<td>70 (89.7)</td>
</tr>
<tr>
<td>Wide and steep (not gently sloped)</td>
<td>3 (3.8)</td>
<td>75 (96.2)</td>
</tr>
<tr>
<td>Not well kept</td>
<td>1 (1.3)</td>
<td>77 (98.7)</td>
</tr>
</tbody>
</table>

3; 65.9% indicated that the elevators are secure and large; 25%, secure and small; 6.8%, insecure and large; 2.3%, insecure and small. These results imply that 90.9% of the elevators are secure and in good condition even though they differ in size. Secured elevators are sensitive to objects coming between the doors by opening instead of jamming when an object comes between the doors while closing. High-quality elevators were installed due to the high rent and the upper class target occupiers. They were not provided for sustainability.

Staircases

Various conditions of staircases based on size, lighting, and cleanliness were examined. These characteristics are presented in Exhibit 4. Fifty-one percent of the respondents indicated that their staircase is wide and gently sloped, 34.6% were of the view that it is well illuminated while 32.1% indicated that it is well-kept. On the other hand, 38 (48.7%) think that their staircase is not wide and gently sloped, while 51 (65.4%) indicated that it is not well illuminated, which is an indication of poor natural lightning in the design; 77 (98.7%) indicated that it
is not well kept and 75 (96.2%) indicated that it is steep and narrow. Steep and dark staircases constitute health and safety hazards, particularly to the elderly and medically challenged.

### Ventilation and Lighting

The results show that for 80 apartments, 79 (98.8%) were well-ventilated. Exhibit 5 shows the distribution of apartment ventilation. The results indicate that indoor air quality is valued.

The findings in Exhibit 6 show that a large number of occupants believe that the lighting in their apartment is good. From the total responses obtained, 96.1% indicated a good lighting condition; 48.7% indicated a very good condition while the remaining 47.4% indicated just good. In addition, 68.4% indicated that natural and artificial lighting are available; while 22.4% indicated that they have only natural lighting in their staircase while 9.2% indicated that they have only artificial lighting, which implies high energy consumption, and a lack of an energy-efficient design.
Door, Window, and Wall Types

The results in Exhibit 7 show that for doors, 73.4% are wide, 5.1% are narrow, and 21.5% are high. For windows, 84.6% are wide, 6.4% are narrow, and 9.0% are high. The findings confirm that most buildings have good windows and doors installed as sustainable features.

The results in Exhibit 8 show that 88.2% of respondents indicated that their walls are high while 11.8% indicated they have level walls. Highly level walls enhance indoor air quality.

Water Efficiency, Light Bulbs, and Ventilation

The results in Exhibit 9 show that 71.9% of respondents’ water taps are fitted with conservation features while 28.1% indicate their taps are not fitted with water conservation features. By implication, the majority of water taps are fitted with sustainable fittings.

Based on results in Exhibit 10, 62.3% of respondents use energy-efficient light bulbs, 41.8% use fluorescent bulbs, and 23% use filament bulb. This implies that a reasonable number of them are conscious of energy efficiency. There is still need for improvement in the use of energy-efficient bulbs. The results also show that some of the respondents use both energy and non-energy efficient bulbs.
The results in Exhibit 11 show that 83.8% of the respondents have more than one light switch in a room. This implies that the number of bulbs that would be on at a time is regulated, which is an energy conservation measure.

The results in Exhibit 12 show that the most important factor that affects respondents’ comfort is poor ventilation. This implies that the building design should incorporate windows with the orientation and size that will enhance natural lighting and ventilation and improve indoor air quality. This is followed by the use of generators with their associated fumes. The generators typically cause both noise and air pollution. This calls for energy solutions that are both efficient and
Green Features and Rental Value

The highest factor that affects occupants comfort is poor ventilation. This implies that building design should incorporate windows that will enhance natural lighting and ventilation and improve indoor air quality. This is followed by the use of generators with their associated fumes. The generators often cause both noise and air pollution. This calls for energy solutions that are both efficient and eco-friendly.

Other factors include noise, improper waste disposal, and poor drainage. All of these have cost implications for occupants and could increase cost of living in the apartments. The results here are also in tandem with those of Robinson, Simons, Lee, and Kern’s (2016) WTP study, indoor air quality ranks highest with respect to rent premium.

This section focuses on the influence of green features on rental values. There are 17 factors examined for this purpose and the outcome is presented in Exhibit 13. Seven factors are within computed MISs of 0.724 and 0.859, which represent a high influence. In hierarchical order of influence on rental value, the first seven
factors are: high energy cost, common generator, durable fittings, windows, balcony, doors, and multiple light switches. The next factors that will influence rental value are: common inverters, flooding, insecure and narrow elevators, poor water conservation, humid room, noisy generators, and improper waste disposal (in descending order). Lack of window shades has the least computed MIS of 0.594. Poor water conservation ranks 11th. This could appear strange, but there is little or no incentive for water conservation in the study areas as residents pay a flat rate for water (Exhibit 14).

The highest WTP is N68,000 for a central use generator while the lowest, N33,020, is for a reduction in energy costs. The highest three WTPs are energy related, which implies that residents are willing to pay more for improved energy efficiency. They would be ready to pay N54,650 and N53,960 for durable fittings and improved water efficiency, respectively. For reduced generator noise and improved ventilation, residents are also ready to pay N52,885 and N50,000, respectively. WTP for efficient waste disposal stood at N43,400 over WTP for provision of window shades, which was N40,400. The WTP pay more compares favorably with the high rentals in the area. It indicates that WTP varies with respect to different sustainability features. This provides supportive evidence for the study by Chan, Queena, and Lam (2009). Energy is a serious problem in both Lagos and Nigeria. This explains the highest WTP for improved electricity and energy efficiency.

The regression analysis is based on 19 dependent variables and one independent variable (rental price) to determine the variables that have a significant impact on rental price either positively or negatively.
### Exhibit 14 | Average Willingness to Pay for Green Features in a Building

<table>
<thead>
<tr>
<th>Feature</th>
<th>WTP (in N) per annum</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centrally used generator</td>
<td>68,000</td>
<td>1</td>
</tr>
<tr>
<td>Standard and efficient generators</td>
<td>65,685</td>
<td>2</td>
</tr>
<tr>
<td>Centrally used power inverters</td>
<td>63,045</td>
<td>3</td>
</tr>
<tr>
<td>Reduced flooding</td>
<td>60,785</td>
<td>4</td>
</tr>
<tr>
<td>Durable fittings</td>
<td>54,165</td>
<td>5</td>
</tr>
<tr>
<td>Improved water efficiency</td>
<td>53,920</td>
<td>6</td>
</tr>
<tr>
<td>Reduction in generator noise</td>
<td>52,885</td>
<td>7</td>
</tr>
<tr>
<td>Improved ventilation</td>
<td>50,000</td>
<td>8</td>
</tr>
<tr>
<td>Good doors</td>
<td>46,169</td>
<td>9</td>
</tr>
<tr>
<td>Balcony</td>
<td>45,332</td>
<td>10</td>
</tr>
<tr>
<td>Good windows</td>
<td>44,894</td>
<td>11</td>
</tr>
<tr>
<td>Efficient waste disposal</td>
<td>43,400</td>
<td>12</td>
</tr>
<tr>
<td>Well illuminated staircase</td>
<td>42,173</td>
<td>13</td>
</tr>
<tr>
<td>Reduced indoor humidity</td>
<td>41,702</td>
<td>14</td>
</tr>
<tr>
<td>Multiple power control</td>
<td>40,871</td>
<td>15</td>
</tr>
<tr>
<td>Provision of tree shades</td>
<td>40,400</td>
<td>16</td>
</tr>
<tr>
<td>Reduction in energy cost</td>
<td>33,020</td>
<td>17</td>
</tr>
<tr>
<td>Overall Average WTP</td>
<td>47,420</td>
<td></td>
</tr>
</tbody>
</table>

$$RVALUE = 0.951 - 0.423 \text{(ENERGY)} + 0.656 \text{(HUMID)}$$

$$+ 1.516 \text{(WINSHD)} - 0.218 \text{(STAIR)}$$

$$+ 1.621 \text{(INCOME)}$$

$$- 0.668 \text{(FACTOR AFFECTING COMFORT LEVEL)}.$$  

The results in Exhibit 15 show that a 10% increase in energy ($\beta = -0.423$, $t = -2.566$, $p = 0.01 < 0.05$) would lead to a 42% decrease in rental values. The $t$-value of $-2.566$ is statistically significant at the 5% level, suggesting that energy is a major determinant of rental values. In addition, HUMID and WINSHD have a direct and significant relation with rental values. A 10% increase in HUMID ($\beta = 0.656$, $t = 19.565$, $p = 0.00 < 0.05$) and WINSHD ($\beta = 1.516$, $t = 12.831$, $p = 0.00 < 0.05$) leads to 65.5% and over 150% in the rental values, respectively. By implication, an increase in HUMID (indoor and quality) and WINSHD have a positive and significant influence on the rental values.

Furthermore, income ($\beta = 1.621$, $t = 10.377$, $p = 0.00 < 0.05$) has a direct and significant relation with the rental values. The results reveal that a 10% increase
Exhibit 15 | Multiple Regression Analysis of Impact of Green Features on Rental Value in Residential Building

<table>
<thead>
<tr>
<th>Unstandardized Coeffs.</th>
<th>( \beta )</th>
<th>Std. Error</th>
<th>( T )</th>
<th>( P )</th>
<th>Partial</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.951</td>
<td>0.889</td>
<td>1.069</td>
<td>0.560</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENERGY</td>
<td>−0.423</td>
<td>0.165</td>
<td>−2.566</td>
<td>0.010</td>
<td>0.226</td>
<td>Significant</td>
</tr>
<tr>
<td>HUMID</td>
<td>0.656</td>
<td>0.034</td>
<td>19.565</td>
<td>0.000</td>
<td>0.426</td>
<td>Significant</td>
</tr>
<tr>
<td>WINSHD</td>
<td>1.516</td>
<td>0.118</td>
<td>12.831</td>
<td>0.000</td>
<td>0.295</td>
<td>Significant</td>
</tr>
<tr>
<td>STAIR</td>
<td>−0.218</td>
<td>0.033</td>
<td>−6.667</td>
<td>0.000</td>
<td>−0.158</td>
<td>Significant</td>
</tr>
<tr>
<td>INCOME</td>
<td>1.621</td>
<td>0.156</td>
<td>10.377</td>
<td>0.000</td>
<td>0.242</td>
<td>Significant</td>
</tr>
<tr>
<td>FACTORS AFFECTING COMFORT LEVEL</td>
<td>−0.668</td>
<td>0.193</td>
<td>−3.460</td>
<td>0.001</td>
<td>−0.083</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Note: The dependent variable is rental value (RVALUE). \( R = 0.889, R^2 = 0.7885, \) Adj. \( R^2 = 0.7841, D-W = 1.89, F\)-statistic = 35.781, and \( p = 0.00. \)

in income leads to a 162% in the rental values. This implies that income is the strongest determinant of the rental value.

In addition, STAIR (dark staircase) \( (\beta = −0.218, t = −6.67, p = 0.00 < 0.05) \) and FACTOR AFFECTING COMFORT LEVEL (other variables affecting comfort level) \( (B = −0.668, t = −3.450, p = 0.01 < 0.05) \) have an inverse significant relation to the rental values. A 10% increase in STAIR and FACTOR AFFECTING COMFORT LEVEL results in a 21.8% and 66.8% decrease, respectively, in the rental values.

Furthermore, the adjusted \( R^2 \) is an estimate of how well the model would fit different data from the same population and its value is always smaller than the value of \( R^2 \). Exhibit 15 shows an \( R^2 \) value (coefficient of multiple determinants) of 0.7885. This implies that 78.85% of the changes in the dependent variable RVALUE are due to changes in the independent variables of ENERGY, HUMID, TREESHD, STAIR, INCOME, and FACTOR AFFECTING COMFORT LEVEL. In addition, the high \( R^2 \) and adjusted \( R^2 \) values indicate the explanatory power of the independent variables. This is considered high enough to determine the statistical significance of the coefficient of determination. The \( F\)-statistics also indicate that the model is a good fit for the estimation because the \( F\)-statistic value of 37.781 is significant at the 5% level \( (p = 0.00) \). Finally, the D-W test \( (D-W \approx 2) \) suggests that autocorrelation is unlikely to be a problem. Consequently, the estimated model can be confidently relied upon for making inferences and predictions.

**Test of Multicollinearity**

I used the correlation matrix table in tests for multicollinearity among the variables. Gujarati (2004) states that two explanatory variables are said to be
multicollinear if the pair-wise or zero order correlation coefficient of the variables exceeds 0.8.

As the results in Exhibit 16 show, there is no multicollinearity among the variables since none of the pair-wise correlation coefficients between any two explanatory variables is above 0.8. Findings from both the CVM and HPM indicate that energy is of primary importance to the tenants as it has the highest WTP and also greatest impact on the rental value. Therefore, energy efficiency should be given priority in investment decisions, followed by indoor air quality, which is influenced by size and orientation of windows, presence of a balcony, flood reduction, etc. There is a close relation between the findings from both the expressed and revealed WTP.

The issue of dark staircases is a consequence of a non-energy efficient design that should have provided for natural lightning. It could therefore be concluded that energy efficiency is key to improved rental value. Low humidity or improved indoor air quality will also increase rental value based on findings from WTP and regression analysis. Thus the findings of the revealed WTP are reasonably in sync with the studies of Feige, Mcallister, and Wallbaum (2013) and Zhang and Dong (2018). Chegut, Eichholtz, Kok, and Quigley (2010), Feige, Mcallister, and Wallbaum (2013), and De Ruggiero, Forestiero, Maganelli, and Salvo (2017) identify energy and water efficiency, health and comfort, building safety, etc. as having significant positive price effects.

**Conclusion**

Creating awareness amongst consumers on the financial and other benefits of lowering operational and maintenance costs will likely reduce building-related illness, increase the productivity and comfort of the occupants, reduce waste and pollution, and increase building and component durability and flexibility, which is essential in creating a viable market for green features. In this study, I examine...
and identify the extent of demand for green features in residential buildings in two prime residential neighborhoods in Lagos. I evaluated the availability of several green features in the buildings under consideration. Some of the features are sustainability compliant while some are not. In the study areas, most of the buildings are unconsciously fitted with green features due to the high rent they command and the caliber of tenants/occupiers. However, there is still a need to improve on energy efficiency as many occupiers still use filament bulbs and fluorescent tubes. Energy-efficient practices are very critical due to rising energy costs and the impact of climate change and the associated rise in temperatures. This elevation in temperatures will result in more intensive use of air conditioners and other cooling systems. The immediate consequence is high energy related costs. Water efficiency practices could be said to exist due to the use of water conservation features. However, the impact of this may be neutralized by the lack of incentives for water conservation. Water billing is not based on consumption but at a flat rate irrespective of consumption.

The results indicate that poor ventilation and insecure elevators followed by private generators are the major sources of occupier discomfort. This is due to the poor indoor air quality arising from poor ventilation. In the case of insecure elevators, some people could become trapped inside during power outages or get injured when elevator doors malfunction. Private generators can be noisy and produce fumes, which at times suffocates and is unhealthy to occupants. High energy costs are associated with operating generators and electricity costs are a major factor in households’ rental decisions. This also coincides with households’ willingness to pay, which is highest in centrally used power inverters as this will reduce the use of generators, which are expensive to maintain due to high fuel costs. This therefore justifies the statement that soaring energy costs provide increased incentives for the real estate industry to respond and by constructing energy-efficient buildings, as well as upgrading the existing housing stock to be more energy efficient and environmentally suitable. Finally, changing environmental conditions need to be managed by integrating sustainable features in buildings. The hazards and challenges posed by dark staircases are a direct consequence of high energy costs. Dark staircases have a negative impact on rent premiums.

The different levels of willingness to pay and findings from the HPM will help architects and developers to determine which building components/services should be given priority based on user preference. In this study, energy efficiency is key. This study will improve in no small measure the scanty literature on sustainable real estate in Nigeria. There is a lot of similarity with the findings from studies on expressed and revealed WTP as energy efficiency tops all other green features (e.g., Chegut, Eichholtz, Kok, and Quigley (2010), Feige, Mcallister, and Wallbaum (2013), De Ruggiero, Forestiero, Maganelli, and Salvo (2017), and Zhang and Dong (2018).

- There is need to establish a green policy and certification standards, so that investors and occupiers will start to benefit from the utility they offer.
- There should be a total stakeholder engagement in the pursuit of a green agenda as this will help to articulate a green agenda for the country.
A strong and robust awareness campaign for green compliance should begin without further delay. This will be supported with evidence of the benefits of green design.

The federal government should lead the drive for importance of a green policy in Nigeria. This will require including it in the educational curriculum in relevant departments of higher institution learning. Energy is a major problem in Nigeria and sustainable design will reduce the energy requirements of the country including the need to build more power stations.

Investors in real estate in the country should strive toward developing buildings with green labels as studies (Oladokun, 2017) have shown that green buildings are quite unique and are priced differently from non-green labeled buildings even when the latter is designed with high specifications.

Further studies should be carried out on the effect of green labels on prime office buildings and the effect of green features on medium-income residential properties in Lagos.

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