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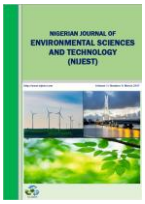

Factors Influencing Users' Preference for Green Features in Residential Buildings: Experience from Ibadan Municipality, Nigeria

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ABSTRACT

The study examines factors influencing users' preference for green features in residential buildings of Ibadan municipality, Nigeria. The study population comprised residents in the five local government area of Ibadan municipality. Using systematic sampling, 267 households were selected for questionnaire survey. Questionnaire was administered on the household heads in the study area. Data obtained were analyzed using percentages and relative importance index (RII). The result showed that 'knowledge regarding benefits of green building' with RII of 4.50 ranked first among factors that influence preference for green features. Other factors with high degree of influence on users' preference for green features in residential building in the study area are the 'level of education' and 'level of income' with RII of 4.48 and 4.46 respectively. The knowledge of the outcome of this study is expected to benefit real estate investors and other stakeholders in property market and promote policy regarding green building development and investment in the country and other emerging nations of the world.

Keywords: Green buildings, Green features, Environmental degradation, Climate change, Global warming, Ibadan

1.0. Introduction

The agitation for green building has risen globally in the past few years. This is in response to the apprehension that green building has the potential to curtail numerous problems that have continued to degrade environment and its capacity to sustain human race. Environmental issues such as greenhouse gas emission, global warming and climate change, flood and erosion have posed a dangerous threat to ecosystem, and consequently to the survival of humankind. For instance, Bharat and Onkar (2013) reported that global warming and climate change have led to the melting glaciers in the arctic and thickness of the sea ice melt at an increasing rate. Evidence abounds that built environment is a major contributor to environmental degradation. United Nations (2014) record shows that the world population consisted of 54% city residents who contributed up to 80% of global annual carbon dioxide emission.

Green building is designed to reduce the overall impact of the built environment on the natural environment and the wellbeing of humanity. It offers certain potential benefits such as energy and carbon emission reduction, waste reduction, efficient usage of water and other resources, and sustenance of occupants' health and productivity (UNGBC, 2009).

Owing to the grievous impact of building activities on the sustainability of environment and incessant campaigning for green building in recent years, research have been carried out in different parts of the globe focusing on green building (Oyewole and Komolafe, 2018a). This is with a view to educating the stakeholders on the essence of green building and what they stand to gain by investing in it.

Meanwhile, most of the studies particularly in the emerging economies essentially focused on office properties. Residential properties were largely neglected. However, most people spend a substantial portion of their time in residential building. Information on issues affecting users' preference for green buildings is expected to guide different stakeholders in building industry. Therefore, this study seeks to investigate the factors influencing users' preference for green features in residential buildings in Ibadan municipality. Information obtained from this study would be a useful guide for investors and developers in providing green buildings in the study area and other cities of developing countries with similar physical, social and economic characteristics. Information from the findings of the study will also be useful for government agencies and policy makers to formulate policies promoting the incorporation of green features in residential buildings to ensure the sustainability of the environment. Studies have been carried out on drivers and barriers to green building development in the developed and some emerging economies. However, it appears that only few studies focused on factors influencing residents' preferences for green building features. Also, studies focusing on the development and adoption of residential green building particularly in emerging economies are sparse as most of the extant studies concentrated on green commercial properties.

The work of Tagaza and Wilson (2006) is an example of studies undertaken to examine drivers and constraints to the development of green commercial buildings in Australia. The authors conducted a series of interviews of key stakeholders in Australia and identified 'perceived financial risks', 'construction risks' and 'current regulatory environment' as the drivers of green commercial building in Australia. The paper advocated among other things the need to establish integrated design team and post- occupancy studies of completed buildings. Mason *et al*. (2011) sought to identify factors that influenced green building in the Pacific Northwest. The study employed both chi square analysis and factors analysis and found that 'policies and guidelines' and 'local experts and supports' were the important factors influencing green building in the study area Apart from the fact that the study was also undertaken in a developed economy with different social and building culture, the study was carried out on commercial properties.

An all-inclusive study focusing on green housing was Salvi and Syz (2011) which sought to identify the determinants of green housing distribution in Switzerland. The authors employed data collected for several variables on demographic, geographic, social, cultural, and political characteristics that may influence green building activity. The result showed that differences in the levels of incomes and cultural differences were the major determinants of green building activity. Though the focus of the study was residential properties, the study was also carried out in a developed economy.

In the United States of America, Cidell and Cope (2014) investigated factors that influence the adoption and impact of LEED based green building policies at the municipal level. The study employed logistic and linear regression and found that the presence of a green building policy was the most significant factor influencing the adoption of green building ahead of demographic and other factors. Darko *et al.* (2017) examined issues affecting the adoption of green building technology in the United States of America. Focusing on the perspective of building experts, the study employed a questionnaire survey and ranking analysis to identify major issues affecting the adoption of green building technology (GBT) and found that 'resistance to change', 'a lack of knowledge and awareness' and 'higher cost' were the most crucial barriers. The result also indicated that 'greater energy and water efficiency' and 'company image and reputation' were the major drivers for adopting GBTs.

One of the most extensive studies on factors driving green building development in emerging economies was carried out by Liu *et al.* (2012) who researched into factors driving and impeding green building development in China. The authors conducted an industry-wide survey on building industry practitioners and found that 'to obtain countenance and incentives from the government' was the dominant factor driving green development while 'High fabrication cost' in design and 'Cost control' in construction were the largest constraints to green building practices.

In Malaysia, another emerging economy, Isa *et al*. (2013) evaluated factors affecting office property investment with a view of establishing the attractiveness of returns expected by property investors. The authors found that returns and risk were the dominant factors influencing investment in green

building. The study concluded that investment in green office building would lead to a new dimension in Malaysian real estate industry.

Low *et al*. (2014) investigated the drivers, challenges and critical success factors involved in green existing buildings in Singapore. The study found that legislation, return on investment and rising energy bills were the three major drivers of incorporating green features in the existing buildings.

In an emerging country in Africa, Muli (2013) examined the factors that influenced green building adoption in Kenya. The author adopted descriptive survey of organizations that have adopted green building technology and found that cost, awareness, local experts, standards, and resistance to change were the major factors influencing green building adoption. Windapo (2014) is another African study which sought to investigate the drivers of green building in South African construction industry. The study employed a multi-case study approach and found that the main drivers of green building were rising energy costs, industry green rating star system, competitive advantage, and legislation. In addition, the study revealed that the key drivers had not changed significantly over time. The findings suggested that increase in green building development was mainly driven by economic rather than ecological factors. Though the studies were conducted in emerging economies, the focus of the studies was on organizations and professionals and not users which is the object of this study.

To consider green premium as a driver of green building in developing countries, Oyedokun (2017) drew lessons from the United Kingdom and United States of America. The study evaluated the available evidence and trends and advocated the development of viable green real estate market in developing countries. Though, the aim of the study was to recommend the development of green building in developing countries such as Nigeria, the study did not consider the opinions of the users to infer the determinants of their preferences.

Studies that sought the opinions of users as to what influenced their inclination for green buildings include Miller and Buys (2008), Addae-Dapaah *et al*. (2009), Leif and Mahapatara (2010), Park *et al*. (2013), Kumar and Ghodeswar (2015), Mortensen *et al*. (2016) and Brom *et al*. (2018). Miller and Buys (2008) explored tenants' perspective on retrofitting office buildings for sustainability in Australia. Conducting semi-structured in-depth interview with seven users and neighbours of the case study structure in Melbourne, the authors employed thematic approach and discovered that the tenants were willing to consider sustainability initiatives peradventure; the process, costs and benefits were made clear.

Addae-Dapaah *et al*. (2009) carried out a survey of 400 commercial real estate users in Singapore and found that cost saving, and higher property value benefits influenced respondents' willingness to embrace green buildings. The study also revealed that price, reliability, and effectiveness of green features as well as apathy towards environmental issues were the major impediments to green building development in Singapore.

Leif and Mahapatra (2010) employed data collected through a survey on owners of detached houses in Sweden to evaluate the factors influencing the adoption of investment measures to improve the energy efficiency of their buildings. The finding shows that personal characteristics such as income, education, age, and contextual factors including age of the house, thermal discomfort, past investment, and perceived energy cost influence homeowners' preference for a particular energy efficiency measure. Although, the study focused on residential property, other green features aside energy efficiency were not considered.

In assessing the residents' preferences for environmental factors of residential properties, Park *et al* (2013) employed both conjunct analysis and ranking method to reveal consumers' monetary value as touching environmental performance. The authors tested consumers' marginal willingness to pay and discovered that energy bill ranked highest in preference while IT facilities ranked lowest. The finding also showed that preferences varied according to respondent's socio-demographic factors.

Mortensen *et al*. (2016) investigated parameters influencing Danish homeowners' adoption of green features relating to energy innovations. The study processed survey on 883 homeowners and found that improvements in comfort, indoor environment and architecture combined influenced homeowners' adoption of the feature. While the results showed that homeowners could not be assumed as one group, the key considerations for determining the motivating factors were related to current positions in life such as age, presence and age of children, time of ownership, occupation, and income.

In the Nigerian context, relevant studies include Komolafe and Oyewole (2015), Komolafe *et al.* (2016), Araloyin and Adejunmo (2017), Oyewole and Komolafe (2018b) and Oyewole *et al.* (2019) among others. Komolafe and Oyewole (2015) sought the opinions of estate surveyors and valuers on users' preferences for green features in office properties. The result showed that the practitioners believed users preferred green buildings to conventional buildings. The finding also revealed that the respondents believed that features associated with occupant comfort were more preferred than eco-friendly features. Aside that the authors failed to probe into the factors that influenced the preferences, the study only sought the opinions of estate surveyors and not the office property users. To bridge the observed gap in the previous study, Oyewole and Komolafe (2018b) examined users' preferences for green features in office properties with a view to determining the degree of their aspirations for green building. The authors used users' preference index and discovered that the aggregate preferences of users for green features was above average. The study also revealed that features relating to 'building ecology, waste and recycling' were the most preferred while those relating to 'owner and occupant ranked least in preference.

Oyewole *et al*. (2019) investigated the level of willingness of property developers to invest in green features in Abuja, the Federal Capital City of Nigeria. The study employed a measure of developers' willingness to invest index on data elicited from property developers and found that developers were more willing to invest in green features that are associated with occupants' comfort than features that confer more of environmental benefits. However, the study did not examine the opinions of property users nor examine the factors that influence the willingness of the developers. to fill the gaps, Oyewole and Ojutalayo (2019) assessed factors that influence developers' willingness to invest green features in Abuja. The authors employed a measure of relative importance index and discovered that 'knowledge and awareness' and 'perceived financial returns and risks" were the dominant factors influencing developers' willingness to invest in green features.

Araloyin and Adejumo (2017) examined the users' preference in residential buildings in Ibadan, Nigeria. The study employed mean ranking and found that features relating to water saving toilet and bath facilities was the most preferred while those relating to owner and occupant education ranked least in the order of preference. Although the study focused on users' preference for residential properties, the study did not verify the factors responsible for the preference. It would be necessary to conduct further study to identify the factors accountable for the respondents' preference for the features which is the object of this study.

2.0. Methodology

2.1. Study area

Ibadan, the capital city of Oyo state in Nigeria is the largest city in West Africa. It is in southwestern part of Nigeria in a hilly environment. Majority of the residents are traders, civil servants and farmers producing variety of agricultural items to meet the food demand of the urbanites. Administratively, Ibadan municipality is divided into 11 local government areas (LGA) (Figure 1). These consist of five urban local government and six semi-urban local governments. However, the focus of this study was on urban residential properties in Ibadan. Hence, the five urban local government areas of the study area were considered. These are: Ibadan North, Ibadan North-East, Ibadan North-west Ibadan South-east and Ibadan South-west. The choice of Ibadan was most suitable because the city is peculiar with various environmental problems and construction activities which can be ameliorated through the incorporation of green features in the built environment.

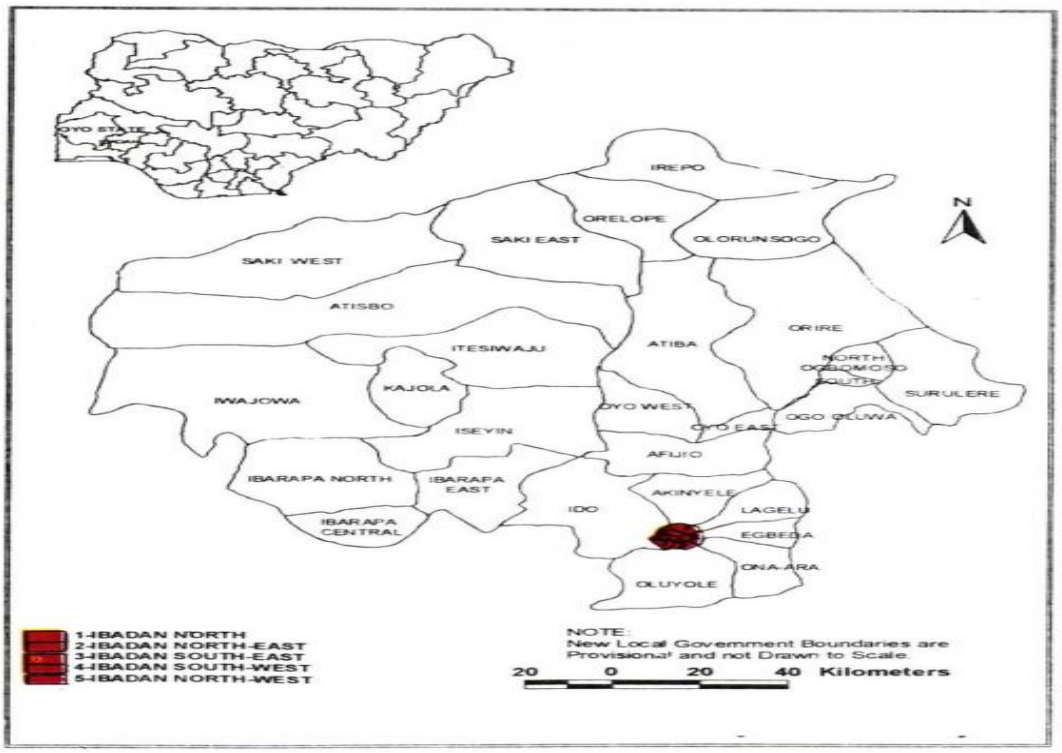

Figure 1: Map of Ibadan showing the local government areas.
Source: Google Map.

2.2. Methods

The data required for the study were collected using questionnaire administered to the residents (tenants and owner occupiers) in the five local governments of Ibadan municipality, Oyo State of Nigeria. In the administration of questionnaire, each local government under the investigation was stratified into the different residential areas i.e., high, medium, and low-density residential zones. There were 2668 houses in the study areas: 1,274 in the high density, 875 in the medium density and 556 in the low-density residential zone. The 10% of these houses were sampled. These sample proportion was considered representative enough. Thus 127, 88 and 56 houses were respectively sampled in high, medium, and low-income areas of Ibadan municipality. The study adopted systematic sampling technique whereby, the first house was selected, and every tenth house was subsequently selected thereafter.

The decision to choose what type of house to develop as owner occupier or which house to occupy as renter in the study area, like in other parts of the country, is usually the responsibility of the household heads. To this end, questionnaire was administered to the household heads in the selected buildings except where this condition is not met, like in the case of bachelors and spinsters. One household in the selected building was sampled.

The data obtained was analyzed through the descriptive method. The analysis resulted into measuring the level of importance attached to variables considered as factors influencing the preference of residents for green features. To achieve this, different factors that can determine the preference of urban residents for green features in the built environment were identified in the literature. The respondents were asked to rate the factors on a 5-point Likert Scale of *Very important (VI), Important (I), Just Important (JI), Not Important (NI), and Not Important at all (NI at all).* The analysis of the respondent's response subsequently evolved into an index called Relative Importance Index (RII). To arrive at the index, the ratings above respectively were assigned a value of 5,4,3,2 and 1. The Sum Weight Value (SWV) for each factor is obtained through the summation of the product of the number of responses for each rating to an attribute and the respective weight value. RII can take the value between 5 and 1 – the closer the RII to five, the higher the users' level of agreement to that factor influencing preference for green features.

The summation of Relative Importance Index for the identified factors divided by the total number of these factors was used to compute the Mean Relative Importance Index ($\overline{RII}$). Deviation about the Mean Relative Importance Index (*RII*- $\overline{RII}$) for each of the Relative Importance Index was also computed. The mean deviations (MD) were only representative measures of dispersion that provided information on either high or low level of importance of the factors.

3.0. Results and Discussion

In presenting the results of the survey, the paper first examined the social economic attributes of the respondents since preference for housing features is a function of one's social economic status.

3.1. Socio-economic attributes of residents

The social economic characteristics considered important to this study are age, sex, marital status, educational qualifications, religion, and source of income. As presented in Table 1, findings show that 51.7% of the respondents were males while their female counterparts accounted for 48.3%. This indicated that males accounted for the highest proportion of the household heads in the study area. This further confirms the general assertion that males are usually the household heads in African setting. It was also revealed that 17.2% of the respondents were less than 35 years of age while those that were between 36-50 years accounted for 19.9%. Furthermore, 62.9% of the respondents were over 50 years of age. Thus, the highest proportion of the sampled residents in the study area was above 50 years of age which indicates that they were mature and experienced citizens. Similarly, it was established that most of the respondents were married. This group represents 58.9% of the sampled residents in the study area. The result of the analysis reveals that 11.0, 13.1, 47.6, 23.0 and 5.2 percent of the respondents had secondary school certificate, national diploma, higher national diploma/first degree, masters, and doctorate degree respectively. Given this outcome, one may conclude that most of the respondents had first degree. This result points to the fact that respondents were highly literate.

Table 1: Socio-economic characteristics of the respondents

Variables	Frequency	Percentage
Sex		
Male	138	51.7
Female	129	48.3
Total	**267**	**100.0**
Age Group		
Less than 35 years	46	17.2
36-50 years	53	19.9
More than 50 years	168	62.9
Total	**267**	**100.0**
Marital Status		
Single	---	0.0
Married	157	58.9
Divorced	13	4.8
Widowed	97	36.3
Total	**267**	100.0
Educational Qualification		
Secondary School Certificate	29	10.9
Ordinary National Diploma	35	13.1
Higher National Diploma/ Bachelor of Science (B. Sc.)	127	47.6
Master of Science (M. Sc.)	62	23.2
Doctor of Philosophy (Ph. D)	14	5.2
Total	**267**	100.0

3.2. Factors influencing users' preference for green features

The results on the degree of influence of 'personal characteristics', 'political attributes', 'financial attributes', 'social attributes' 'healthy and productivity attributes' and 'maintenance attributes' on users' preference are as presented in Table 2 – the closer the RII of an attribute to 5, the higher the assumed degree of influence on users' preference.

The result as revealed in the table indicates that most of the attributes have a RII greater than 2.5. This shows that the attributes had significant impact on the users' preference for green features in the study area. Specifically, the most influential category of attributes was 'financial attributes' with RII of 4.12 while the least influential category was 'social attributes' with an RII of 2.89. Other categories of attributes are 'personal characteristics', political attributes', 'health and productivity attributes' and 'maintenance attributes' with RII of 4.12, 3.00, 3.85 and 2.89 respectively. The average RII for all factors is 3.66. The result implies that majority of the attributes had significant impact on the users' preference for green features in the study area. Financial attributes constituted the most important category of factors affecting users' preference for green features. The result is in consonance with Miller and Buys (2008) and Addae-Dapaah *et al*. (2009) shows that users were more inclined to put economic issue ahead of social and environmental considerations in their willingness to embrace green building. The finding also reveals that 'financial attributes' ranked highest among the groups of factors influencing users' preference for green features. As this finding support the study of Oyewole and Ojutalayo (2019) opined that factor influence developers' willingness to invest in green features were perceived financial returns and risks with other dominant factors. The implication of this is that users were more interested in economic benefits in terms of cost associated with green buildings than social and environmental benefits.

Table 2: Factors influencing users' preference for green features

Factors	**RII**	**Group Ranking**	**Overall Ranking**
Personal Characteristics			
Age	3.32	5	15
Level of income	4.46	3	3
Level of education	4.48	2	2
Occupation	3.85	4	13
Knowledge regarding benefits of green building	4.50	1	1
$\overline{RII}$	**4.12**		
Political Attributes			
Availability of policies and guidelines	2.95	3	18
Availability of regulatory apparatus	3.01	2	17
Incentives from governments	4.01	1	10
Complexity of certification	2.02	4	22
$\overline{RII}$	**3.00**		
Financial Attributes			
Cost	4.33	1	4
Ability to command good resale value	4.25	2	6
$\overline{RII}$	**4.29**		
Social Attributes			
Level of environmental friendliness	3.50	1	14
Compatibility with culture and aesthetics tradition	2.51	3	21
Availability of local expertise and supports	2.65	2	20
$\overline{RII}$	**2.89**		
Health and Productivity Attributes			
Extent of occupant comfort in use	4.19	2	7
Level of health and safety risks	4.33	1	4
Productivity enhancement	3.02	3	16
$\overline{RII}$	**3.85**		
Maintenance Attributes			
Ease of maintenance	4.16	2	9
Ease of building facilities operations	4.01	3	10
Extent of possible unfamiliar building defects	2.84	5	19
Long term use and usefulness	4.17	1	8
Operation cost liability	3.98	4	12
$\overline{RII}$	**3.81**		

$\overline{RII} = 3.66$

Further analysis indicates that four of the six groups of factors had positive deviations about the mean of factors influencing users' preference for green features. These attributes are 'personal attributes', 'financial attributes, 'health and productivity attributes' and 'maintenance attributes. The implication of this is that the degree of influence of these factors is higher than the aggregate influence of factors influences the preference of users for green features in residential properties. The deviations about the average RII for the factors for the respective attributes are 0.46, 0.63, 0.19 and 0.15. Other attributes such as political attributes and social attributes had negative deviations (-0.66 and -0.77) about the mean of RII.

Under 'personal characteristics', 'knowledge regarding the benefits of green building' (RII=4.50) constituted the most important feature influencing the preference of users for green features. The reason is that users will only embrace green features when they are informed and convinced of the benefit associated with green features. The results also reveal 'level of education' and 'level of income' were rated high as factors influencing users' preference for green features in residential properties with RII of 4.48 and 4.46 respectively. This cannot be unconnected with the importance of the duo in promoting the adoption of green building. While the level of education influences the level of awareness of green building concept, incorporating most of the green features requires extra cost. The average RII for the variables under 'personal characteristics' was 4.12. Other variables with RII higher than the average are 'level of education' and 'level of income'. The implication of this is that the degree of influence of each of these factors is greater than the aggregate influence of 'personal characteristics' on users' preference for green features. The deviations about the mean of RII for 'personal characteristics' for the above respective variables are 0.38, 0.36 and 0.34.

As regards the category of variables under 'political attributes', the variables which ranked highest in terms of degree of influence is 'incentives from government' (4.01) while 'complexity of certification' (2.02) ranked least. The average RII for the category of attributes in the group is 3.00. The other variable with the RII higher than the average is 'availability of political apparatuses with an RII of 3.01. The result implies that users' inclination for green building will surge when government put necessary incentives and political apparatus in place. The result also reveals that other factor such as 'availability of policies and guidelines' and 'complexity of certification' have negative deviations about the mean of RII of political attributes. The implication of this is that the degree of influence of these factors on users' preference is lower than the average influence of political attributes on users' preference for green building. And this could also mean that government was not doing enough in terms of policies and guidelines and their enforcement.

Among the two financial attributes, cost with an RII of 4.33 ranked first in terms of importance in influencing users' preference for green features in residential properties in the study area. It can also be observed that cost ranked fourth among the twenty factors influencing users' preference for green features. The other factor in the category is 'ability to command good resale value' with an RII of 4.25 ranked sixth among the twenty-two factors. The degree of influence of cost on users' preference is explained by several reasons. Perhaps the most important is that the users might not be able to afford the associated rent premium as renters or incorporate certain costly green features as owner occupiers.

Under social attributes, 'level of environmental friendliness' (3.50) constituted the most important factor influencing users' preference for green features. Other factors in the group are 'availability of local experts and supports' (2.65) and 'compatibility with culture and aesthetic tradition' (2.51). Further analysis indicates that two of the three attributes in this group have RII lower than the average RII (2.89). These are 'availability of local supports' and 'compatibility with culture and aesthetic'. The implication of this is that the degree of influence of these attributes is lower than the aggregate influence of this group of attributes.

Regarding health and productivity attributes, 'level of health and safety risk' ranked first with an RII of 4.33 closely followed by 'extent of occupant comfort in use' (RII = 4.19) while 'productivity enhancement' (RII = 3.02) ranked least in the group. It can also be observed that two of the features had positive deviation about the mean RII of the group implying that their RII is higher than the aggregate RII of attributes relating to health and productivity.

As observed from table, 'long term use and usefulness' (4.17) ranked first among the attributes relating to maintenance. This implies that green features associated long term use and usefulness could be of interest to residents of the study area. It can also be observed that 'ease of maintenance' (4.16) ranked as the second most influential factor among the maintenance attributes. This suggests that residents were positively inclined to green features that are easy to be maintained. Further analysis reveals that one factor in this category (extent of possible unfamiliar building defects) had negative deviation about the mean of RII for maintenance attributes. The implication of this is that the degree of influence of this factor was below average of the RII for the group. From this finding, it is observed that residential property users will be highly inclined to invest in green features that can be easily maintained.

4.0. Conclusions

The paper provided information on the factors that influence users' preference for green features in residential properties in Ibadan, Nigeria. The RII was used to determine the degree of influence of six groups of factors. The results demonstrated that the degree of influence of most factors was higher than the average (2.50 out of 5.00).

To promote users' desire for green features that confer environmental and social benefits in the country, conscious efforts through spirited campaign by all stakeholders in green movement is of the essence. There is the need to educate the property developers and users (tenants and owner occupiers) on the need importance of investing in green features that confer social and environmental benefits. This will not only conform to global trends but ensure the preservation of habitat for future generation.

Another result of the study that is critical to promoting green building adoption in Nigeria is that 'knowledge regarding benefits of green building' ranked first among factors that influence inclination for green buildings. This suggests that awareness of the benefits of adopting green building will motivate the users to embrace green features. There is therefore the need to embark on aggressive campaign to educate users on the economic, social, and environmental benefits that green features would confer.
The analysis also revealed that political such as 'availability of policies and guidelines' and 'availability of regulatory apparatus' raked low in the degree of influence on users' preference for green features.

To enhance the adoption of green features by the property developers and users in Nigeria, all tiers of government should formulate policies and guidelines, and put the necessary machinery in place to ensure compliance by property developers, investors, and users.

It is essential to mention some of the limitations of this study. First, data collected on factors influencing users' inclination towards green features in Nigerian as in many emerging property markets present some difficulties owing to the absence of property data bank. The evaluation as to the variables influencing preference for green features was based on the perception of residents. Second, understanding the opinions of developers and investors to invest in green features in residential properties might provide an insight to the level of willingness to invest in green building, though outside the scope of this study. This is left for further study.

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