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Costs and Benefits of Green Features in Buildings, Victoria Island, Lagos as a Case Study

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Abstract

The development of Green buildings in Nigeria is still new and unknown to many. However, Lagos State has seen the development of buildings with green features, features including solar panels, rain water harvest systems, Variable Air Volume etc. present in certified green buildings are now incorporated in regular buildings in a bid to green them. This research paper weighs both costs and benefits of these features in commercial and residential buildings in the Victoria Island area of Lagos state.

It was established that costs can easily be stated in monetary value determined by the open market while benefits cannot, hence, prompting that the research data are collected via open end questionnaires with respondents limited to experts i.e. professionals in property development (employment of expert survey technique). Benefits were measured based on willingness to pay; a mode of contingent valuation for determination of monetary values. Cost Benefit Analysis is then employed to compare costs to benefits with result being a basis for investment decision making in property development.

Analysis of data collected for the research shows that using cost benefit analysis, building occupants in Victoria Island, Lagos are willing to pay occupy 'green' residential buildings because they feel the benefits exceed the cost other than use commercial buildings with green features for their business operation. This implies that for an investor who wishes to incorporate green features into his development, it is a wise investment decision to do so for residential buildings as there are more prospective clients.

Keyword: Green Building, Cost, Benefit, Cost Benefit Analysis, commercial buildings and residential buildings

1.0 INTRODUCTION

Building is considered a major asset to man, institution; households and government are all stakeholders in building construction in order to provide accommodation for themselves and their activities. Uses to which buildings can be put range from residential to commercial and industrial uses. Uses of buildings are often subject to regulations of different nature to ensure its production and use conforms to human needs. (Oladokun, Gbadegesin and Ogunba 2010)

Regardless of type, size and use, buildings in most cases have a significant negative impact on the natural environment. The National Building Museum in its introduction of its "Big& Green; Towards sustainable Architecture in 21st Century" exhibit states that "these structures consume enormous amounts of energy on their construction and day-to-day use, place great borders on water and sewer systems and isolate occupants from natural lighting and ventilation".

Green Building focuses on the construction of structures with minimum environmental footprint such it optimizes material utilization, water, energy and other resources. The scope of Green Building exceeds just incorporation of „Green" features i.e. energy efficient fittings to buildings; it involves incorporation of „Green" features considering the design, cost and performance.

According to Governor's Green Government Council (2010), Green Building is a "whole-system" approach that promotes strategies rather than specific solutions and in order to find balance of five key principles; sustainable site design, water quality & conservation, energy & environmental optimization, indoor environmental quality and materials and resources efficiency. Similarly, the United States Environmental Protection Agency (2017) opined that "Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life cycle from siting to design, operation, maintenance, renovation and deconstruction".

2.0 LITERATURE REVIEW

2.1 What makes Building green in Lagos, Nigeria?

Green Buildings are gaining forces in Nigeria. Numerous studies on green buildings have been conducted in Nigeria by researches. Otegbulu (2010) analyzed the effects of Green design on environmental sustainability including it implication and occupier's preference with respect to building components and services to ascertain the level of their appreciation of green elements. Wherein, the study found that Nigerians are not green conscious on building design and environmental management.

Like every other place on the globe, green buildings in Lagos are distinct from conventional buildings in term of Efficient Energy Use. Cullen (2000) explained that buildings can incorporate green features but if they do not use energy efficiently, it is difficult to demonstrate that they are truly green. He intensified that the energy performance of a building is calculated using standards that indicate the insulation of the components, position and orientation of the building on site in relation to climatic aspect, exposure and it capacity for renewable energy sources and other factors.

Green Buildings in Lagos, Nigeria are products of sustainable design process. Sustainable design process according to Reed and Gordon (2000) is an integrated design process exhibited in Green building constructions which encompasses cross-disciplinary teamwork which enables the improved integration of buildings, natural and economic systems. The construction team includes energy specialist and bio-climatic engineer and series of additional consultants.

Another significant feature of green buildings in Lagos like every other green building is the Visual Comfort. Sources of light are combination of both natural and artificial. Lighting in these buildings considers heat gain, glare, different light levels, solar penetration and uniformity.

The United States Green Building Council (USGBC) LEED Green Building Rating System explain green building provide a healthy, comfortable and productive indoor environment for building occupants. A noticeable characteristic of Green Buildings in Lagos is that they afford best possible conditions in terms of indoor air quality, ventilation and thermal comfort, access to natural ventilation and day lighting and effective control of the acoustical environment.

2.2 Overview of Noticeable Green Buildings in Nigeria

2.2.1 Heritage Place, Ikoyi, Lagos

A landmark development in Lagos and is the first environmentally certified commercial building in Lagos city. Heritage place comprises of 15,736sqm of office space over eight floors, serviced by a double height reception and 350 private car parking spaces. Green features of the building are; between 30-40% reduction in energy use, high efficiency lighting, heat recovery, high level of indoor air quality, Pulverized fuel Ash (PFA or Fly Ash) etc. Heritage Place is LEED certified as green.

2.2.2 Wing Towers, Victoria Island, Lagos

Located on Ozumba Mbadiwe Avenue, Wing Towers is an office complex consisting of approximately 27,000sqm of lettable space across 12 floors. The iconic structure is LEED certified and offers world class facilities.

Green features include roof construction at level seventeen comprising an extruded aluminum louvered screen which conceals the roof plant area, curtain wall screens provide adequate visual screening. Supply of air is distributed throughout the Air-screening. Supply of air is distributed throughout the Air-Conditioned areas by way of externally insulated galvanized sheet metal ducts installed in the ceiling void and introduced into the space by means of ceiling mounted Variable Air Volume (VAV).

2.2.3 Nestoil Towers, Victoria Island, Lagos

Strategically located in Victoria Island, Lagos. Occupying a land size of 3900sqm with leasable space for commercial use measuring about 10,000sqm. Green features include Energy efficient glass curtain walls, Green high efficiency HVAC Variable Air Volume (VAV), Fresh Air Recycling plant and Heat Recovery System.

2.3 COSTS AND BENEFITS OF GREEN BUILDING FEATURES.

2.3.1 Cost of Green Building Features

Cost is the price paid or required for acquiring, producing or maintaining project usually measured in money, time or energy expended. According to Clifford (2013) while green materials and technologies do cost more, it has been demonstrated that many green strategies and technologies cost the same and some even cost less than conventional technologies.

The most criticized issue about constructing environmentally friendly buildings is the cost, new appliances and modern technologies tend to cost more money. Most Green Buildings cost a premium of <2% but yield 10 times as much over the entire life of the building (Kats, Leon, Adam, Evan and Jeff, 2008).

It is important to note that when considering cost during decision making, cost include initial cost and running cost. Initial cost of acquisition of green feature and installation cost while running cost include cost of maintenance: repair and serving.

2.3.2 Benefits of Green Building Features

The United States Green Building Council (USGBC) a system created to define and measure Green Buildings classified Green Buildings benefits into categories; environmental, economic and social benefits.

Environmental according to USGBC consider the benefit Green buildings offer to our climate and immediate natural environment. "Green Buildings can not only reduce or eliminate negative impacts on the environment by using less water, energy or natural resources; they can in lot of cases have positive impact on the environment by generating their own energy"

Economic Benefit also referred to financial benefit according to USGBC includes cost saving on utility bills, lower construction costs, job creation and higher property value for building developers.

Social Benefits go beyond economic and the environment and have been shown to attract positive social impacts too. A research led by David Mcnamara (2011) on quantifying the hidden benefit of High-performance building emphasized that there are numerous intangible benefits of Green Buildings. David opined that these benefits include improved company brand equity and goodwill, improved occupant comfort and productivity.

3.0 RESEARCH METHODOLOGY

3.1 Source of Data Collection

In a bid to gather the data that was used in this research, Primary Source was used due to the type of information sought. This source of data collection provides a means of collecting first-hand information for the research: Questionnaires and Oral Interview.

3.2 Target Population

The target population is a smaller representation of the whole population examined. It is the total number of people about whom this research is embarked on and from where conclusion will be drawn. The target population of this study comprises of members of the Real Estate Development Association of Nigeria (REDAN) and property owners with good/basic knowledge of what green feature are in Victoria Island.

3.3 Sampling Frame

It is the list of every member of the population from which samples were taken to aid in analysis and allow for division into further frames for more in-depth analysis. The professional members of the Real Estate Development Association of Nigeria (REDAN) in Lagos state are chosen as the sample frame. Their total number is 157. Based on the uniqueness of this research thesis, number of property owners must match that of the of the professionals (REDAN Members).

3.4 Sample Size

Yemane"s demographic formula will be employed, and the sample size for the professionals in Lagos State will be:

$$n = N / [1 + N(e)^2]$$

Where, n = Sample size for a finite population
N = Size of population (Total number of Registered Estate Firms)
e = Level of significance (10%)
Substituting each value in the equation above n = 107/ [1 + 107(0.1 * 0.1)]
n = 107/ [1 + 107 (0.01)]
n = 107/ (1 + 1.07) n = 107/ (2.07)
n = 51.69
Approximately n = 52

3.5 Questionnaire Design

The questionnaire contains a combination of closed and open-ended questions. The open-ended questions permit respondents to give detailed answers in cases where their experience cannot be articulated into few options.

3.6 Sampling Technique

For the purpose of this research, Expert Survey was employed. Expert Survey is a technique that allows researchers to gain information from specialists in a field where the researcher is less knowledgeable or qualified. For example, if asked with surveying the public's stance and awareness on environmental issues, one could create a preliminary expert survey for a selected group of environmental authorities. It would ask broad open-ended questions that are designed to receive large amounts of content, providing the freedom for the experts to demonstrate their knowledge. From their input a survey covering all sides of the issue can be created.

However, due to the fact that the development of green buildings is a new one in Lagos and the estimation of costs and benefits in money terms can be done by only experts with knowledge of contingent valuation and are actively involved in green building development. Expert Survey was utilized in selecting members who are knowledgeable and can give accurate information for the research. When conducting the research, it was discovered that, of the 52 REDAN members from the sample size, only 38 could supply the required data for the research.

3.7 Method of Data Analysis

Cost-benefit analysis (CBA) originated with Jules Dupuit, (a French engineer) in 1848 and was later formalized in the UK by Alfred Marshall. In the US, impetus to the use of CBA came as a result of the Federal Navigation Act of 1936 which required that the U.S. Corps of Engineers carry out projects for the improvement of waterway systems when the total benefits of projects exceeded the project costs. In the UK, Litchfield began to popularize the technique in his writings culminating in the prominence given to the technique in the UK with the controversial choice studies during the analysis conducted for citing of the third London Airport. Cost-benefit analysis (CBA) is the examination of a decision in terms of its consequences or costs and benefits (Stephanie Riegg Cellini, James Edwin Kee (2010). To identify the total benefits with the cost of a single program or a policy to society, CBA is one of the best measurement scale. To identify the economic benefit of making any given investments, and select and rank the project from numerous investment options, cost benefit analysis is the best way.

Ogunba and AJayi (2018), posit that Cost Benefit Analysis is sometimes called Planning Balance Sheet; they established that CBA is a powerful, widely used and relatively easy tool for deciding whether to implement a public project. It is similar

in concept to Net Present Value (NPV) because it discounts costs and benefits, but also social and environmental costs and benefits. CBA is a technique for establishing whether proposed public projects are worthwhile to the community based on analysis of financial or economic, and social costs against benefits.

When performing the analysis, the most crucial part is to transform estimations of benefits over costs into today's money value. Other than that, calculating net present value (NPV) is a relatively easy way to examine a stream of current and future benefits and costs. That represents the present value of an investment's future financial benefits minus any initial investment. (United State Green Building Council, 2003).

In order to provide a consistent measure of costs and benefits, future costs and benefits are discounted to produce Present Values (PV). The major merit of the CBA according to scholars is that it is simple to understand, looking whether benefit outweighs costs, when done quantitatively it is measuring the monetary value of benefits and the costs involved in the project. It is applicable to both new and old projects but a generally complications may arise as the CBA requires accurate unit of measurement; this may be difficult on cases of qualitative benefits sometimes referred to as intangible benefits by researchers.

Cost-Benefit Analysis is dependent on Cost Benefit Ratio. The universal decision rule for Cost Benefit Analysis (CBA) is that a proposed project with cost-benefit ratio lesser or equal to 1 is advised to be embarked on; project with cost-benefit ratio greater than 1 should be rejected.

Accepted project when CBA ratio ≤ 1
Reject project when CBA ratio > 1

Since Cost Benefit Analysis is a technique for decision making from a list of options, for this research, residential development (3-Bedroom flat) and administrative/commercial development are considered.

4.0 DATA PRESENTATION AND DISCUSSION

The presentation of data is systematically linked to the format of the self-developed questionnaire attached in the appendix and this is done after obtaining perception of equal number of property owner in the study area and members of the real estate developers association of Nigeria (REDAN) determined in the sample size.

4.1 Features that makes Building Green in Lagos, Nigeria.

S/N	FEATURES	HA	A	N	U	HU	WMS	Rank
1	Natural Lighting	22	19	7	1	2	4.11	**2nd**
2	Natural Ventilation	22	21	2	4	2	4.11	**2nd**
3	Rain water Harvest System	13	20	4	8	4	3.47	**5th**
4	Water Condenser from cooling units	12	21	14	3		3.76	**4th**
5	Variable Air Volume	4	7	8	13	19	2.29	**7th**
6	Energy Efficient Glass	6	5	16	13	11	2.64	**6th**
7	Solar Panels	28	20	3			4.49	**1st**

Where; HA-Highly Available, A-Available, N-Neutral, U-Unavailable, HU-Highly Unavailable
Source: Author's Computation 2018

As it can be observed, solar panel as a feature in green buildings has a weighted mean score of 4.49 meaning that the respondents attest that the feature is highly available in buildings with green features in Lagos. Next in rank is natural lighting and natural ventilation with weighted mean score of 4.11, the implication is that both features are very available next in line to the solar panel. Water condenser from air cooling units, rain water harvest system and energy efficient glass are ranked 4th, 5th, and 6th respectively. The variable air volume (VAV) with weighted mean score 2.29 is ranked 7th which is last, the meaning of this is that the VAV is a green feature absent in most buildings incorporated with green features.

COST OF NATURAL LIGHTING IN GREEN 3-BEDROOM FLAT

Cost (In Thousand)	Frequency	Percent
1-100	24	100
Total	**24**	**100**

Source: Author's Computation 2018

COST OF NATURAL VENTILATION IN GREEN 3-BEDROOM FLAT

Cost (In Thousand)	Frequency	Percent
1-100	24	100
Total	**24**	**100**

Source: Author's Computation 2018

COST OF RAINWATER HARVEST IN GREEN 3-BEDROOM FLAT

Cost (In Thousand)	Frequency	Percent
1-100	24	100
Total	**24**	**100**

Source: Author's Computation 2018

From the 24 respondent (Members of REDAN), the table 4,5 and 6 shows that 100% of the professionals declared that the cost of incorporating natural lighting, natural ventilation and rain water harvest system into 3-Bedroom flat ranges between 1000 to 100, 000 thousand naira.

COST OF WATER CONDENSER IN GREEN 3-BEDROOM FLAT

Cost (In Thousand)	Frequency	Percent
1-100	4	16.7
101-200	4	16.7
Absent	16	66.7
Total	**24**	**100**

Source: Author's Computation 2018

A research into the cost of incorporating water condenser from the perception of professionals reveals that 16.7% agree that the cost ranges from 1-100 thousand naira, 16.7% also established that the cost to provide water condenser system ranges between 101-200 thousand naira. 66.7% are of the opinion that the feature is absent in 3-Bedroom flat.

COST OF ENERGY EFFICIENT GLASS IN GREEN 3-BEDROOM FLAT

Cost (In Thousand Naira)	Frequency	Percent
1-500	4	16.7
501-1000	4	16.7
1001-1500	4	16.7
Absent	12	50
Total	**24**	**100**

Source: Author's Computation 2018

Cost of energy efficient glass according to professionals is said to vary based of variation in lifespan of the product, quality and brand. It was however reveal by the survey that 16.7% agree that the cost ranges between 1-500 thousand naira, 16.7% revealed that it is between 501, 000- 1, 000, 000 naira, in the same vein, 16.7% said it is between 1-1.5 million naira while a larger amount of the professional 50% are of the opinion that energy efficient glasses are not in green 3-Bedroom flats.

COST OF SOLAR PANEL SYSTEM IN GREEN 3-BEDROOM FLAT

Cost (In Thousand Naira)	Frequency	Percent
101-200	8	33.3
201-300	4	16.7
301-400	12	50
Total	**24**	**100**

Source: Author's Computation 2018

33.3% revealed that cost of incorporating solar panel in green features is between 101-200 thousand naira, 16.7% revealed the feature will cost between 201-300 thousand naira in the same building type. The largest percentage 50% revealed that the feature will cost between 301-400 thousand naira to be incorporated in 3-Bedroom flat.

AVERAGE COST OF GREEN FEATURES IN 3-BEDROOM FLAT

RESPONDENT	INITIAL COST (NAIRA)	ANNUAL RUNING COST (NAIRA)
1	730000	62500
2	1480000	45200
3	734200	29000
4	282000	44300
5	1825000	64000
6	2081000	632500
7	731000	62500
8	2080000	45500
9	2180000	29000
10	731500	34300
11	292700	61600
12	1895000	63200
13	790000	62500
14	2380000	49500
15	512000	28590
16	734200	34300
17	289000	54000
18	1895000	63000
19	782000	45500
20	730200	46500
21	1895000	26000
22	1595000	36300
23	797800	67200
24	736500	62000

Source: Author's Computation 2018

AVERAGE INITIAL COST= N1, 174,129.167 AVERAGE ANNUAL RUNNING COST= N72, 873.58

According to the survey conducted, this implies that it takes about N1, 174,129.167 to acquire or purchase and install green features in 3-Bedroom flat in Lagos. This is inclusive of the professional fee that will be required. An average of N72, 873.58 is required annually to ensure continuous operation of the features, this include cost of repairs, servicing and varieties of maintenances.

COST OF NATURAL LIGHTING IN OFFICE BUILDING

Cost (In Thousand Naira)	Frequency	Percent
1-100	11	78.6
101-200	3	21.4
Total	**14**	**100**

Source: Author's Computation 2018

A total number of 14 respondents are specialized in the development of office buildings. 78.6% of the respondents are on the stand that it will cost between 1-100 thousand naira to incorporate efficient natural lighting in office buildings, 21.4% estimated the cost of feature to range between 101-200 thousand naira.

COST OF NATURAL VENTILATION IN OFFICE BUILDING

Cost (In Thousand Naira)	Frequency	Percent
1-100	14	100
Total	**14**	**100**

Source: Author's Computation 2018

COST OF RAIN WATER HARVEST SYSTEM IN OFFICE BUILDINGS

Cost (In Thousand Naira)	Frequency	Percent
1-100	14	100
Total	**14**	**100**

Source: Author's Computation 2018

Natural Ventilation and Rain water harvest system as green features in office buildings according to respondents has cost ranging from 1-100 thousand naira. This is evidenced by the result of the survey with 100% of respondents agree to the cost range.

COST OF VARIABLE AIR VOLUME IN OFFICE BUILDINGS

Cost (In Thousand Naira)	Frequency	Percent
Absent	3	21.4
1-500	6	42.86
501-1000	2	14.3
1001-1500	3	21.4
Total	**14**	**100**

Source: Author's Computation 2018

Cost between1-500 thousand was estimated by 42.86% of respondents, 14.3% put cost of incorporating Variable air volume (VAV) in office buildings to be between 501 thousand and 1 million naira. Cost between 1 million to 1.5million was estimated by 21.4% of the professionals, the same percentages are of the opinion that the feature is not a green feature incorporated in office buildings in Lagos.

COST OF ENERGY EFFICIENT GLASS IN OFFICE BUILDINGS

Cost (In Thousand Naira)	Frequency	Percent
1001-1500	5	35.7
1501-2000	9	64.3
Total	**14**	**100**

Source: Author's Computation 2018

35.7% of professionals explained that the cost of the features in office buildings is between 1-1.5 million naira while 64.3% of the respondent put the cost at 1.5-2 million naira.

COST OF SOLAR PANEL SYSTEM IN OFFICE BUILDINGS

Cost (In Thousand Naira)	Frequency	Percent
501-1000	11	78.6
1001-1500	3	21.4
Total	**14**	**100**

Source: Author's Computation 2018

Solar panel as a very common green feature in buildings has it cost estimated by all respondents. 78.6% of respondents put the cost between 500 thousand naira and 1 million naira. 45 21.4% are of the opinion that the cost of incorporating an efficient solar power system in office buildings ranges between 1-1.5 million naira.

AVERAGE COST OF GREEN FEATURES IN 3-BEDROOM FLAT

RESPONDENT	INITIAL COST (NAIRA)	ANNUAL RUNNING COST (NAIRA)
1	5222000	283000
2	4070000	217000
3	3147000	297000
4	3265000	215000
5	3805000	486000
6	5822000	283000
7	4210000	213000
8	3047000	297000
9	3265000	225000
10	3283000	406000
11	5822000	283000
12	4020000	217000
13	3047000	237000
14	3213000	215000

Source: Author's Computation 2018

AVERAGE INITIAL COST= N3, 945,571.43 AVERAGE ANNUAL RUNNING COST= N276, 714.29

Based on the survey, on the average, it takes about N3, 945,571.43 to purchase green features for an office building and install the features, this is inclusive of the professional fee that will be required. On an average scale, N276, 714.29 will be

required annually to ensure continuous operation of the features inclusive of cost of repairs, servicing and varieties of maintenances.

INCREASED PATRONAGE FROM ENVIRONMENT CONCIOUS TENANTS IN GREEN 3-BEDROOM FLAT.

Benefit in Thousand Naira	Frequency	Percent
201-300	13	61.9
301-400	8	38.1
Total	**21**	**100**

Source: Author's Computation 2018

The data collected is represented on the graph below, 61.9% estimate money value of benefit in 3- bedroom flat to range 201-300 thousand per annum and 38.1% put the cost to be within 301-400 thousand naira.

INCREASED PATRONAGE FROM GOVERNMENT IN GREEN 3- BEDROOM FLAT.

Benefit in Thousand Naira	Frequency	Percent
201-300	17	81
301-400	4	19
Total	**21**	**100**

Source: Author's Computation 2018

REDUCTION IN SICK LEAVE IN GREEN 3-BEDROOM FLAT.

Benefit in Thousand Naira	Frequency	Percent
6--10	8	38.1
11--15	4	19
16--20	3	14.3
26--30	3	14.3
36--40	3	14.3
Total	**21**	**100**

Source: Author's Computation 2018

INCREASED LEVEL OF PRODUCTIVITY IN GREEN 3-BEDROOM FLAT.

Benefit in Thousand Naira	Frequency	Percent
Absent	21	100
Total	**21**	**100**

Source: Author's Computation 2018

All respondents are of the opinion that 3-bedroom flats are for residence and are not for manufacturing or any other process which may involve output generation. 100% of the residents established that productivity is not a benefit in 3-bedroom flats with green features.

REDUCTION IN ENVIRONMENTAL IMPACT IN GREEN 3-BEDROOM FLAT.

Benefit in Thousand Naira	Frequency	Percent
1--10	10	47.6
11--20	3	14.3
21--30	8	38.1
Total	**21**	**100**

Source: Author's Computation 2018

From the survey conducted, about 47.6 of residents are willing to pay between 1-10 thousand naira to enjoy the benefit, 14.3% are willing to pay 11-20 thousand naira, and 38.1% are willing to pay 21-30 thousand naira. Comparing with other benefits,

„reduction in environmental Impact" is the least benefit residents want to pay to enjoy. This is reflected by the ranges of amount they are willing to pay (Max amount during the time of this research is N30, 000), the indirect implication is that Lagos residents do not value the effect of surrounding environmental condition and it effects.

AVERAGE BENEFIT OF GREEN FEATURES IN 3-BEDROOM FLAT

RESPONDENTS	BENEFITS (NAIRA)
1	766000
2	590000
3	630000
4	630000
5	745000
6	615000
7	726000
8	575000
9	630500
10	630000
11	751000
12	515000
13	767000
14	590000
15	632000
16	650000
17	762000
18	615000
19	701000
20	590000
21	640000
22	617000
23	747000
24	644000

Source: Author's Computation 2018

AVERAGE BENEFIT= N1, 260,680

Average benefit enjoyed yearly in a 3-bedroom flat with green features incorporated in it on an average scale is about N1, 260,680 per annum.

INCREASED PATRONAGE FROM ENVIRONMENT CONCIOUS TENANTS IN OFFICE BUILDING

Benefit in Thousand Naira	Frequency	Percent
1-100	3	21.4
101-200	6	42.9
201-300	5	35.7
Total	**14**	**100**

Source: Author's Computation 2018

INCREASED PATRONAGE FROM GOVERNMENT.

Benefit in Thousand Naira	Frequency	Percent
1-100	3	21.4
101-200	11	78.6
Total	**14**	**100**

Source: Author's Computation 2018

INCREASED PATRONAGE FROM GOVERNMENT.

Benefit in Thousand Naira	Frequency	Percent
1—15	2	14.3
16-20	6	42.9
26-30	3	21.4
31-35	3	21.4
Total	**14**	**100**

Source: Author's Computation 2018

INCREASED PATRONAGE FROM GOVERNMENT

Benefit in Thousand Naira	Frequency	Percent
51-100	3	21.4
101-150	11	78.6
Total	**14**	**100**

Source: Author's Computation 2018

The above table shows the ranges of money term respondents are willing to pay to enjoy the benefits.

AVERAGE BENEFIT OF GREEN FEATURES IN OFFICE BUILDING

RESPONDENT	BENEFITS (NAIRA)
1	337000
2	354000
3	490000
4	527000
5	542000
6	336700
7	390000
8	472000
9	515000
10	524000
11	317340
12	324000
13	488000
14	399700

Source: Author's Computation 2018

AVERAGE BENEFIT= N429, 767.1

Average benefit enjoyed yearly in office building with green features incorporated in it is about N429, 767.1 per annum.

The rate on long term government bond in the country is 15.232 (central bank of Nigeria, 2018) while inflation rate currently stand at 11.23%
Applicable rate for Cost Benefit Analysis = 15.232% – 11.23% = 4.002

COST BENEFIT ANALYSIS OF INCORPORATING GREEN FEATURES IN RESIDENTIAL BUILDINGS (3-BEDROOM FLAT)

YEAR	0	1	2	3	4	5	6	7	8	9	10
COST											
	1174129	72874.58	72874.58	72874.58	72874.58	72874.58	72874.58	72874.58	72874.58	72874.58	72874.58
BENEFITS											
	0	1260680	1260680	1260680	1260680	1260680	1260680	1260680	1260680	1260680	1260680
NET											
BENEFITS											
	1174129	1187805.42	1187805.42	1187805.42	1187805.42	1187805.42	1187805.42	1187805.42	1187805.42	1187805.42	1187805.42
PRESENT											
VALUE											
	1	0.961519971	0.924520654	0.888894507	0.85473844	0.821848808	0.790022334	0.759815524	0.7305778	0.702465150.675343427	
	-1174129	1142098.633	1098150.644	1055893.78	1015262.95	976195.6037	938631.568	902512.9981	867784.272	834391.9078029284.482	

COST = N1, 174,129 BENEFIT= N9, 633,206.835
COST BENEFIT RATIO = 0.121

COST BENEFIT ANALYSIS OF INCORPORATING GREEN FEATURES IN OFFICE BUILDING (5 UNITS OF OFFICE SPACE)

YEAR	0	1	2	3	4	5	6	7	8	9	10
COST											
	3945571	2767143	2767143	2767143	2767143	2767143	2767143	2767143	2767143	2767143	2767143
BENEFITS											
	0	4297671	4297671	4297671	4297671	4297671	4297671	4297671	4297671	4297671	4297671
NET BENEFITS											
	-3945571	1530528	1530528	1530528	1530528	1530528	1530528	1530528	1530528	1530528	1530528
PRESENT VALUE											
	1	0.96152	0.924521	0.888945	0.854738	0.821848	0.790225	0.759816	0.730578	0.702465	0.675434
	-3945571	1471613	1413906.7	1360359.6	1308920.1	1257780.2	1209945.9	1162921.9	1117817	1075143	1033777.1

COST = N3, 945,571 BENEFIT= N1, 241,272
COST BENEFIT RATIO = 3.18

The universal decision rule for Cost Benefit Analysis (CBA) is that a proposed project with cost- benefit ratio lesser or equal to 1 is advised to be embarked on, project with cost-benefit ratio greater than 1 should be rejected.

Accept project when CBA ratio ≤ 1
Reject project when CBA ratio > 1

From the research, using cost benefit analysis as an appraisal technique, prospective developers are advised to develop 3 Bedroom flat in Lagos state. The research shows that the incorporation of green features in 3 Bedroom flat is accepted by prospective occupiers who place high value on benefits attached to presence of green features. This can be used as a yardstick for other residential developments, prospective occupiers both those who want to occupy as tenants and those who want to acquire residential properties by purchase place high value on availability of green feature and are willing to pay substantial amount to enjoy ownership or possession.

On the other hand, the cost-benefit ratio for office buildings was estimated to be 3.18, the higher ratio of the two property type studied. The interpretation of this is that it is an unwise development to incorporate green features in an office building in Victoria Island, Lagos State. Current occupiers of office buildings and prospective ones

in this area do not place high value on green features in the building type; rather they require regular physical workspace to carry out office practices. Incorporation of green features in such building type may be a loss to an investor.

5.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of findings

1. Solar panel systems, natural lighting and natural ventilation are common incorporated in buildings as green features than features such as efficient glass and variable air volume.
2. This study revealed that there is high level of variation in amount respondent are willing to pay to enjoy same benefit.
3. The result of the research proves that incorporating green features residential buildings is highly valued by people in Lagos than other property classes.
4. The people in Lagos state place high value on the place of shelter i.e. residential properties and features that can affect it other than other building types.

5.2 Recommendations

In the light of research findings and conclusion, the following recommendations are made:

1. Green features and their significance in environmental impact should be made known to the member of the public to promote it incorporation in buildings.
2. Researches into the advisability of investment in properties with green features should be conducted at interval and be used as guide by prospective developers. This is because variable factors involved in appraisal are very susceptible to change.
3. Prospective developers should consult researchers with studies into appraisal of development project.
4. Government should lead by example by occupying and developing buildings with green features. This study reveal that the amount recorded as benefit enjoyed from patronage by government is low.
5. Professionals in the built environment should take course on sustainable property development (incorporation of green features in properties) so as to broaden their knowledge in this aspect of the profession and thereby making them relevant in this age that we are in or them handover to the upcoming professionals.
6. The use of cost-benefit analysis requires valuation of less quantifiable benefits, the knowledge of valuation of sustainable properties should be impacted in schools.

5.3 Conclusion

This study has identified features that make a building green in the study area, appraised incorporation of green features into different property types in recognition of important role of the impact of the physical environment. The study presented analysis of costs and benefits of features that makes buildings green through the review of literature and statistical tests based on the perception of members of the Real Estate Developers Association of Nigeria (REDAN) and measure of willingness to pay by individuals. This was done on two property types; residential and commercial, using an example of each as a case study.

Finally, an important point that this study stressed is the measure of costs to benefits using cost benefit analysis. Prospective investors need to recognize that the desire to achieve maximum return from investment in properties with green features require the evaluation of public opinion; how much people are willing to pay to enjoy the features and forgo the conventional property type

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