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Stakeholders Perception of Factors Determining the Adoptability of Green Building Practices In Construction Projects In Nigeria

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ABSTRACT
Within the Nigerian construction industry there has been a lack of research profiling the adoptability of green building practices in construction projects. The aim of this study is to investigate factors determining the adoptability of green building practices. The objectives of the study are to compare perception of stakeholders on factors determining the adoptability of green building principles in construction projects and also to find out the constraints in implementing green building principles. A structured questionnaire was used to collect information from various respondents who were built environment professionals. Random sampling technique was used to select one hundred and fifty (150) respondents out of which ninety-one (91) responses were used for the data analysis. The data collected was analyzed using descriptive statistics. Results indicated that green building practices adoptable by building industry professional include, site sustainability, material and resource conservation, energy conservation, maintenance and building operation, occupant health and safety, water conservation, recycling and waste reduction. Barriers affecting green practices include lack of awareness, expertise and higher cost. The findings have important implications for policy and practice. The study recommends full establishment of Green Building Council of Nigeria (GBCN) that will be responsible for awareness creation, introduction of guidelines, tools and techniques that will drive green building practices for future project.
KEYWORDS: Adoptability, Green Building, Nigeria, Perception, Stakeholders.

1. Introduction

The importance of building to nation's economy cannot be overemphasized as they provide and support most economic activities. Evidence shows that the building sector is responsible for high energy consumption, solid waste generation, global greenhouse emission, external and internal pollution, environmental damage and resource depletion (Chan, Tse & Chung, 2010). Building design, construction, operation and maintenance require innovation in both engineering and management dimensions. Therefore, a far more responsible approach other than the conventional method becomes imperative which will satisfy the needs with regard to development without damaging the world we live in. The method adopted can provide a model from which technological, social, environmental and economic issues would be used to manage buildings towards sustainable future. In view of the above, green building concepts are gaining popularity to serve as a standard to mitigate the environmental impact of new and existing building stock.

Green building is the practice of creating healthy facilities designed and built in a resource efficient manner, using ecological based principles. Green building brings together vast array of practices and techniques to reduce the impact of building on energy consumption, environment and human health. Globally, the trend towards green building practices have been accepted as a number of buildings have incorporated the principles. According to Ahn, Pearce,Wang, and Wang (2013) it is asserted that construction stakeholders and their professional organizations including the American Institute of Architects (AIA), Associated general contractors (AGC), National Association of Home Builders (NAHB), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHREA), and American Society of Civil Engineers (ASCE) are giving attention on the gains associated with green building practices. Since the adoption of Brundtland Report of 1987 which paved way to a new thinking called sustainable development, new strategies for improvement on environment has emerged.

In Umar and Khamidi (2012) it is reported that many progressive world events had taken place to increase the awareness on environmental and sustainability goals such as Rio Earth Summit of 1992, Maastricht Treaty of 1992, Kyoto Conference on Global warming of 1997, Johannesburg Earth Summit of 2002, and Washington Earth observation Summit of 2003. Furthermore, Washington Earth Observation Summit of 2003, UN-HABITAT Conference on Promoting and Fostering Green Building Rating Systems (GBRS) in Africa 2010, African Development Forum of 2012, Swiss Asian Environmental forum of 2013 and Brussels Green Week

Conference of 2014 are world events promoting sustainability in the built environment. The ideas and plans instituted by these world events have inspired actions by many countries to implement and incorporate sustainability principles within their built industry. Subset to this principle is green building. However, through green building concept the construction industry can contribute in a positive and proactive manner to environmental protection.

Numerous studies (Udechukwu and Johnson 2008; Nwokoro and Onukwube 2011; Otegbulu 2011; Abolore 2012 and Adegbile 2013) on sustainability and in particular green building have been conducted in Nigeria by some researchers. Studies of Nwokoro and Onukwube (2011) has assessed the current practices and challenges of sustainable construction, Otegbulu (2011) analyzed the effects of green design on environmental sustainability including its implication and occupiers preferences 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 in building design and environmental management. Abolore (2012) compared the perception of the building professionals/developers of sustainability in building construction industry in Nigeria and Malaysia. A similar study by Udechukwu and Johnson (2008) suggested that adherence to green principles of design increases the bottom line of economic, environmental and human value. Furthermore, Adegbile (2013) study proposed a green building rating system applicable to Nigerian construction industry. In overall, there is paucity of research efforts that glean the perceptions' of stakeholders in understanding adoptability of green building practices in emerging country like Nigeria.

In view of these research efforts in Nigeria and for the fact that most construction projects have not totally adopted green building principles, it may be necessary now to investigate the perception of stakeholders on whether these green building principles can be adopted in most of our construction projects. The study hence investigates the adoptability of green building practice in Nigeria. The aim of this study is to investigate factors determining the adoptability of green building practices. The objectives of the study are to compare perception of stakeholders on factors determining the adoptability of green building principles in construction projects and also to find out the constraints in implementing green building principles in construction projects. The study contributes to literature in construction management and also to knowledge in adoptability of green building principles as well as the constraints in implementing green building principles in construction projects. It will be of good importance to the academia and to those practicing green building in developed and developing countries.

2. Concepts of Green Building in Construction Projects

Various studies on green building have used various terminologies to denote the concept of green building. Green building involves the practices that reduce the environmental impact of components of the built environment which include: green building, green architecture, sustainable building, high performance building and low impact development. This is clearly supported by assertion presented in Fischer (2010). The study points out the differences in meaning ascribed to green building from standard practices to those aimed of environmental impact. Fischer (2010) views green building as integrated building practices that significantly reduce the environmental footprint of building in comparison with standard practices. In a similar vein, Ahn, Pearce, Wang & Wang (2013) termed green building as healthy facilities designed and built in a resource-efficient manner, using ecologically based principles. Chatterjee (2009) defines green building practice as a process to creating buildings and infrastructure in a way that minimize the use of resources, reduce harmful effects on ecology and create better environment for occupants.

Other definition as giving by Kamana and Escultura (2011) define green building or sustainable building as an outcome of a design which focuses on increasing the sufficiency of resource use: energy, water, and materials while reducing building impacts on human health and environment during the building's lifecycle through better location, design, construction, operation, maintenance and removal. Pan, Dzeng and Yang (2011) added that a green building is an outcome of a design philosophy which focuses on increasing the efficiency of resource use. Thus, it can be deduced from the definitions, that green building is a form of practice(s) in which buildings are designed and built without causing environmental degradations throughout the entire building lifecycle exhibiting high level of environmental, economic and social performance. However, the potential for improving the environment by harnessing the expertise and practices available in built environment makes green building a

viable option. These definitions of green building are in line with the way green building is used in the present study.

The concept of green building has been adopted by many nations as a viable option of preserving resources and sustaining the environment (Samer, 2013). Documentations on green building suggest that green building has been used worldwide and according to Reed, Bilos, Wilkinson, and Schulte (2009) developments on green building practices are traceable to UK's Building Research Establishment (BRE) that pioneered the first assessment scheme called Building Research Establishment Environmental Assessment Method (BREEAM) in the year 1990 followed by USA Green Building Council's Leadership in Energy and Environmental Design (LEED) in 1996. As this concept has taken a global phenomenon, most developed and developing countries have resulted in adopting it of which Nigeria is no exception. Nwokoro and Onukwube (2011) study identified the prevailing laws promulgated by Federal Government of Nigeria to safeguard the Nigerian environment. These laws include: Federal Environmental Protection Agency Act of 1988 (FEPA), National Policy on Environment (NPE) of 1989 and Environmental Impact Assessment Act of 1992 (EIA Act). Also, there were concerted efforts by professional bodies and private organisations indicating their commitments towards sustainable buildings. Shaba and Noir (2014) documented the existence of Green Building Council of Nigeria (GBCN) at prospective membership level with World Green Building Council. The report revealed that the newly established council is yet to produce any rating tool thus necessitating willingness by Green Building Council of South Africa (GBCSA) to allow the adoption of Green Star SA in rating Nigerian buildings pending when Green Building Council of Nigeria (GBCN) will establish and has the capacity to develop and operate its own rating system. The concept of green building is advocated for use in building development and operations so that environmental degradation caused by building practices will be minimised.

3. Factors Determining Adoptability of Green Building Principles in Construction Projects

Previous studies of (Augenbroe and Pearce, 2009; Zhang, Plattern and Shen, 2011; Nwokoro and Onukwube, 2011; Otegbulu, 2011) have identified major principles of green building. According of Augenbroe and Pearce, (2009) fifteen (15) elements of green building have been identified to include: energy conservation measures, land use regulations and urban planning polices, waste reduction measures, resource conservation strategies, indoor environmental quality, friendly energy technologies, re-engineering design process, proactive role of material manufactures, better measure and account for costs, new kinds of partnership and projects, adoption of incentive programmes, education and training and recognition of commercial buildings as productivity assets. Also in Zhang, Plattern, and Shen (2011) some green building principles identified include: energy efficiency, water efficiency, material efficiency, indoor environmental enhancement as well as operations and maintenance optimisation are categorised as principles of green building practice. Furthermore, this study classifies green elements into two strategies of architectural (passive) and mechanical (active). Active strategy refers to building design that does not require mechanical equipment for heating or cooling, which deals directly with the building envelope (air permeability, exterior walls, doors, windows and roofing), how it is oriented in other to optimise solar gain and loss and thus reduce energy consumption and life time costs , the use of sustainability sources and low carbon emissivity while in contrast, active design strategy refers to the use of artificial mechanical or electric green technologies to heat, cool or light a space which may include air conditioning, artificial lighting, elevators, escalators, pumps and fans. Also, Nwokoro and Onukwube (2011) identify nine (9) elements that increase the sustainability of the built environment which include: energy efficiency, integrated design, indoor air quality, thermal comfort, visual comfort, site sustainability, acoustic comfort, spatial comfort and building integrity.

The study of Otegbulu (2011) equally highlights eleven (11) dimensions of green design to include: energy and water efficiency, waste reduction, building operation, construction, maintenance, occupant health and productivity, storm water management, climate and environmental integration. However, there is similarity in the different principles of green building identified by the various researchers. A green building will not necessarily have all the above stated principles, since no building can be totally green (Otegbulu, 2011). Therefore, the study will adopt: energy efficiency; water efficiency; environmental and resource conservation; recycling and waste reduction; site sustainability; indoor air environmental quality, maintenance and building optimisation in its investigation. Data obtained represents the perspectives of stakeholders to adoptability of green building principles to construction projects in Nigeria.

4. Constraints in implementing green building principles in construction projects

The realisation of green building practice in the built environment has challenges. These challenges when mitigated would encourage sustainable practices in the built environment. Chan et al (2009) carried out a market survey for green building in developed Asian cites in Hong Kong and Singapore. The aim of the study is to explore the situation of green building marketability and the business rationale of stakeholders to invest in the green building market. The results are similar to what was obtained by Ahn et al (2013) that was carried out in USA and Hong Kong. Studies indicate that the main barrier in achieving green building practices lied on the initial construction cost of green projects when compared to convectional building. A related study on the Chinese construction industry by Zhang et al (2011) that surveyed the costs and barriers in applying the green elements to the process of developing property projects. Results of this study indicated that there exist higher costs for green appliance design and energy savings material at the design stage. The nature of the barriers found out include: insufficient policy implementation effort, technical difficulty during the construction process, risks because of different contract form and site change practices and behaviours, unfamiliarity with green technologies which results in delays in the design and construction process.

The study of Umar and Khamidi (2012) on the support for green building awareness initiatives in Malaysia was based on the public but not a profession issues. The report revealed that although there are guildlines being developed for execution of green building concepts but there were some uncertainties in the application of the document as a result of unfolded sections that mitigate their achievement. This study advocated a shift in position in order to keep pace with the trend of development in the developed economies. The study of Alnaser and Flanagen (2007) which targeted policy makers, architects and contractors on the need of sustainable buildings construction in the kingdom of Bahrain is aimed to initiate sustainable construction on single issue of energy: photovoltaic and wind energy. The study revealed the most significant reasons why solar and wind energy are not forced to be integrated into buildings by policy makers. Barriers to this include: low cost of electricity; availability of oil and natural gas; solar and wind electricity are more economical if they are used for rural areas, while most of the buildings in Bahrain are close to the national grid facility. Also other barriers include: lack of experience and knowledge of local engineers and technicians in solar and wind technology (installation and maintenance); absence of the awareness of public and investors on advantages of using solar or wind energy, especially when dealing with the cost of kWh as well as cost of each Watt from solar and wind electricity; no taxation system in Bahrain, especially in electricity consumption and its environmental sequences; absence of future strategic plans, regulations and schemes to encourage the user to opt for sustainable building construction and initial cost of building-integration photovoltaic or wind energy. On the part of architects, the study revealed that they possess no knowledge about the potentials of solar and wind energy and their cost implications compared to conventional electricity. Furthermore, the survey reported a high optimism by the contractors in adopting the technology by engaging subcontractors to overcome challenges.

According to Hes (2005) as cited in Hankinson and Breytenbach (2012) that integrating green innovation into the built environment is a “wicked” problem, which makes identifying of barriers as essential. This study pointed out that Stieg (2006) presented similar observations in referring to the practice of sustainable design as both difficult and complex. It further suggests that designers should understand the social and moral obligations associated with sustainable design while acknowledging that the practice of sustainable design presents various difficulties. Researches conducted in the United States of America (USA) and Australia suggested that although there was interest in sustainable design, its frequency of application is poor (Hankinson and Breytenbach, 2012). These authors identified multiple barriers to incorporate sustainable design into practice. These include perceived cost and time to source materials, education and training, understanding and in- house experts. Studies also identified client resistance knowledge of materials, limited material selection and authenticity of suppliers along with understanding of the impact of materials, accurate and accessible information and appropriate tools. Other barriers that were identified include: client demands, client knowledge and call backs from clients, accurate and accessible information and appropriate tools, recovery of long-term saving not reflected in service fee structure, potential extension of project schedule, insurance and liability problems with offering warranty on non-standard green materials or methods, conflicts of public policy and/or regulations, and a lack of integrated work environments and communication among all construction stakeholders. The scientific and technological knowledge base for green building is also limited in Nigeria, which is not surprising given the recent origin of the discipline (Roy and Gupta, 2008; Ahn et al, 2013; Fischer, 2010). These barriers are relevant to the present study as this research explores all factors affecting adoptability of green building in construction projects in Nigeria.

5. Methodology

A literature review was first undertaken to determine issues around green building concept, principles and constraints of green building in construction projects in Nigeria. Research instrument used is the questionnaire that was designed to elicit information on respondent's views on issues such as the level of interest and expertise in possible green project; methods of green building concept willing to be adopted; perceived barriers of green building in construction projects in Nigeria among others. A questionnaire survey was adopted because it can be used to gather information from large samples. This is similar to methods used in earlier studies (Salami and Olaniyan 2010; Abolore, 2012; Ahn, et al 2013). Questionnaire survey was the preferred option, because it can be used to gather information from large samples and result can be used for further statistical analysis. The study took place in Lagos State in Nigeria being the economic, financial and commercial nerve centre of Nigeria. Population of the study includes construction professional's (Architects, Builders, Civil and Services Engineers, Estate Surveyors, Town Planners and Quantity Surveyors). The study adopted random sampling techniques were questionnaires were delivered directly to respondents and filled questionnaires were retrieved two weeks after the administration.

In all, one hundred and fifty (150) questionnaires were distributed to various respondents selected for study. Ninety one (91) responses were retrieved for data analysis. According to Moser and Kalton (1971) the result of a survey could be considered as biased and of little value if the response was lower than 30-40%, the response rate for the research is 61% which indicate an unbiased and higher value of survey. Tables were used for representing descriptive result. Mean scores were used for analysis of the study as most of the variables were measured on nominal scale while few of the variables were measured on ordinal scale. The averaging statistical analysis was also used to calculate straightforward totals, percentages and averages.

6. Results and discussions

The result of the study will be discussed under the following headings:

6.1 Characteristics of respondents that participated in the study

Characteristics of respondents that took part in the study are presented in Table 1. From the result presented, it is shown that for the type of business of respondents, 32% of the respondents are contractors, 31% in Academia, 12% are in Engineering firm, 8% in Architectural firm, 7% in Facility management firm, 4% in Consultancy services, 3% are in Government agencies, 2% are owner/developer and 1% in Project management firms. This reveals that the respondents job description fall closely in line with built environment professions. Moreover, results in Table 1 on academic qualification of respondents indicate that 46% of the respondents have M.sc degrees, 44% possess HND/BSC certificates and degrees, 5% have PGD degrees while 3% and 2% have PhD and OND respectively. Since most respondents have M.Sc and HND/BSC degrees, they are academically qualified to provide vital and relevant information on adoptability of green building practices in construction projects in Nigeria. Further results from Table 1 indicate that 43% have 5 -10 years of experience, 31% of the respondents have below 5 years experience, 12 % of the respondents have 11-15 years of experience while 7% have 16-20 years of experience and more than 20 years experience respectively. It can be inferred that most of the respondents have a reasonable level of experience. In terms of professional status of the respondents from the results in Table 1, it indicates that 42% of the respondents are graduate members, 30% are corporate members, 26% are associate members while the remaining 2% are fellows. Since the respondents are members of different professional bodies in built environment generally, they must have been exposed to green building practices at various meetings.

Table 1: Characteristics of Respondents that participated in the study

	Frequency	Percentage (%)
Types of business		
Architectural firm	7	8
Contractors	29	32
Owner/developer	2	2
Government agency	3	3
Facility management firm	6	7
Consultancy firm,	4	4
Project management firm,	1	1
Engineering firm	11	12
Total	91	100
Academic Qualification		
OND	2	2
HND/B.Sc	40	44
PGD	4	5
M.Sc	42	46
Ph.D	3	3
Total	91	100
Years of experience		
below 5	28	31
5 -10	39	43
11-15	11	12
16-20	6	7
Above 20	7	7
Total	91	100
Professional Status		
Associate member	24	26
Graduate Member	38	42
Corporate Member	27	30
Fellow	2	2
Total	91	100

6.2 Factors Determining the Adoptability of Green Building

Strategies for reducing negative environmental impact of buildings on the environment are the green efforts most often implemented or planned by professionals. From the results in Table 2 it is indicated that 22% of the respondents are both willing to adopt environmental and resource conservation strategy and also willing to consider site sustainability concepts. 20% of the respondents indicated that energy conservation is a concept to adopt, 12% are willing to adopt maintenance and building operation strategy, 7% of the respondents have occupant's health and safety and water conservation as principles to adopt while 5% of the respondents are willing to adopt recycling and waste reduction principles. From the results in Table 2 it indicates that 5% of the respondents are willing to adopt all the green building principles. These results suggest that the most important factors determining the adoptability of green building are the environmental and resource conservation, site sustainability and energy conservation**.** Adoption of environmental and resource conservation, site sustainability can enhance green practices as well as energy conservation which reduces carbon emissions from buildings.

Table 2: Factors Determining the Adoptability of Green Building

	Frequency	Percentage (%)
Methods		
material and resource conservation	20	22
Site sustainability	20	22
Energy conservation	18	20
Maintenance and building operation	12	12
Occupant health and safety	7	7
Water conservation	6	7
Recycling and waste reduction	4	5
All	4	5
Total	91	100

6.3 Barriers to Green Building Practices on Construction Projects

The various barriers affecting green building practices on the construction projects are summarized in Table 3. From the survey results in Table 3 it is indicated that lack of awareness from client (owner/ developer) (MS = 4.03) ranks first, too hard to find contractors with green building design expertise (MS = 3.86) ranks second, lack of knowledge and understanding from design professionals (MS = 3.82) ranks third while high cost for sustainable materials and products (MS = 3.71) ranks fourth. These results also indicate that the most important barrier to green building practices is the client's lack of awareness and professional's lack of knowledge of green construction methods and techniques. This finding is valid because if especially professionals do not update their knowledge on green construction and techniques it will be difficult to bring new ideas and innovations into built environment. On the average the results revealed that difficulty in quantifying/measuring energy and environmental impact (MS = 3.48) ranked fifth, adds significantly to initial costs of construction (MS = 3.41) ranked sixth, building have unique design and operational concerns (MS = 3.22) ranked seventh, too hard to find materials for green building/ sustainable design' (MS = 3.21) ranked eighth , extension of project schedule and green facilities are hard to justify even on the basis of long-term savings (MS = 3.10) ranked ninth while tendency to maintain current practices (MS = 3.0) ranked tenth. These results demonstrate that initial project costs are more severe barriers to green building practices. This may arise as a result of higher costs for green appliance design and energy savings material at the design stage. In relation to long pay back periods from implementing sustainable principles (MS = 2.95) raked eleventh, company has other program needs that are more important' (MS = 2.92) ranked twelfth , too complicated'(MS = 2.75) ranked thirteenth, not comfortable with new technology(MS = 2.60) ranked fourteenth, green building doesn`t provide enough flexibility (MS = 2.52) ranked fifteenth, green building conflicts with or complicates with existing laws or regulations (MS = 2.48) sixteenth, too much paper work (MS = 2.47) seventeenth while green design/operations may introduce increased control risk (MS = 2.37) eighteenth. These results suggest that lack of awareness, expertise and higher cost are major impediments for successful adoption of green building practice in Nigeria while factors such as green building conflicts with or complicates with existing laws or regulations, too much paper work and green design/operations may introduce increased control risk are perceived as the least barriers to green practices in construction projects in Nigeria. The results of this study demonstrate that awareness, cost and expertise are the most important barriers to green building practices. This finding is in agreement with Esa, Marhani, Yaman, Raid and Adnan (2011) who identified lack of awareness, education and information as obstacles in implementing green building projects in Malaysia. This finding also supports Hankinson and Breytenbach (2012), whose study in KwaZulu Natal Province of South Africa found that the most significant factor hindering the implementation of green building practices include: education, cost, product and materials rating tools and client.

Table 3: Barriers to Green Building Practices on Construction Projects

	Mean	Rank
lack of awareness from client (owner/ developer)	4.03	1
too hard to find contractors with green building design expertise	3.86	2
lack of knowledge and understanding from design professionals	3.82	3
high cost for sustainable materials and products	3.71	4
difficulty in quantifying/measuring energy and environmental impact	3.48	5
adds significantly to initial costs of construction	3.41	6
building have unique design and operational concerns	3.22	7
recovery of long term savings not reflected in services fee structure	3.22	7
too hard to find materials for green building/ sustainable design	3.21	9
extension of project schedules	3.10	10
green facilities are hard to justify even on the basis of long-term savings	3.10	10
tendency to maintain current practices	3.00	12
long pay back periods from implementing sustainable principles	2.95	13
company has other program needs that are more important	2.92	14
too complicated	2.75	15
not comfortable with new technology	2.60	16
green building doesn`t provide enough flexibility	2.52	17
green building conflicts with or complicates with existing laws or regulations	2.48	18
Too much paper work	2.47	19
green design/operations may introduce increased control risk	2.37	20

7. IMPLICATIONS OF THE STUDY FOR POLICY, THEORY AND PRACTICE

The study is aligned to previous research (see Chan et al 2009; Esa et al 2011; and Hankinson and Breytenbach, 2012) and provides further evidence that the barriers militating against green building practices stem mainly from lack of awareness from built environment stakeholders. It can be inferred from the results of this study that the more knowledgeable the built environment professionals and clients are, the more the adoption of green practices in construction projects in Nigeria. Implication of these findings for policy makers in government and practitioners is in the full development of assessment schemes for rating buildings. The findings of this study also provide evidence to support the green building theory that site sustainability planning, energy conservation, water efficiency, indoor air quality and material conservation all enhance sustainability practices.

8. Conclusions

Based on the findings of this study it can be concluded that green building adoptability by the built environment professionals and clients have been enhanced by highlighting host of factors that will determine the adoption of green building practices to include: site sustainability, energy conservation, water efficiency, indoor air quality and material conservation in construction projects. Building industry professionals had very good agreement on their ranking of the barriers of green projects and they perceived most of the barriers as limiting factors to the adoption of green practices. Professional bodies should train and educate their members on green principles to ensure awareness and knowledge of the practice. To maintain effective sustainable practice on projects, professionals need to attend seminars, conferences and training programmes to improve their knowledge of green design, construction, methods and techniques. Finally, this study recommends full establishment of Green Building Council of Nigeria (GBCN) that will be responsible for awareness creation, introduction of guidelines, tools and techniques that will drive green building practices for future project. More research studies should be undertaken on other states in Nigeria.

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