

A Study on the Challenges and Prospects of Green Building Construction for Sustainable Urbanization in Jos Metropolis, Nigeria

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-----ABSTRACT-----

The construction industry cannot be totally absolved of such practices that adversely impact the environment, thus, new initiatives called eco-green; sustainable buildings were employed to ensure environmental sustainability. However, despite these initiatives, green building development and sustainable practices are not really practiced in Nigeria. This study aims to identify, examine and outline the benefits, prospects and factors hindering green building development based on professionals' perceptions in Jos, Nigeria. Literatures were reviewed to identify these hindering factors, while the primary instrument of data collection being survey questionnaire in which a total of 50 were administered, out of which 37 were retrieved. Based on the responses analysis and Relative Importance Index (R.I.I) on a four (4) point ranking scale, findings revealed that green building is currently not practiced despite the need. "Builders/developers preference to conventional methods of construction" and "lack of awareness" with R.I.I ranking of 0.8041 and 0.7973 respectively were identified as the main hindering factors, and closely followed by market expectation of green building developments among Stakeholders (R.I.I 0.6689). On the other hand, "preservation of natural resources" (R.I.I 0.9662) and "health and productivity" (R.I.I 0.9054) were identified as the most important benefit/prospects of green construction, closely followed by "economic and financial benefits" (R.I.I 0.8716). Though the responses revealed that majority are aware of green construction, however, for the benefit of the general public, it is recommended that Legislation / policy and general awareness on green construction practices should be intensified; as such would encourage sustainable construction practices in Jos metropolis.

KEY WORDS: construction industry, development, environment, green building, sustainability

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I. INTRODUCTION

The size of population in urban areas increases due to rural-urban migration of people. This phenomenon creates a shortage of available housing, leading to more construction of buildings. All of these facts and circumstances such as rural-urban migration create not only environmental pollution, the construction cost, energy consumption and also the use of natural resources during building constructions have been on the increase (Gunajit, 2014). With increase in modernization, urbanization rate has also been on the increase around the world and Nigeria is not an exception. According to (Seifolddini & Mansourian, 2014), urban population surged from 14% in the 1900s to about 50.5% in 2010. Similarly, unprecedented population growth coupled with developmental activities in Jos has led to urbanization according to (Adzandeh, et al., 2015). The undesirable form in urban growth could be said to have negative impact on the environment, human health and natural resources, and has also resulted in some socio-economic problems. Thus, the adoption of the green building concept which is regarded to be eco-friendly becomes of immense importance in order to achieve a sustainable urbanization (Gunajit, 2014).

Green building, according to U.S GBC (2012) is the main principle of sustainable construction referring to a resource-efficient method of building construction in terms of economy, durability, utility and comfort. It should be sensitive to the impact on people, environment, and world at large in terms of resource, financial, and energy consumption (Greg, 2003), while being environmental friendly in terms of energy and water use, and wastewater / storm-water re-use (Zane, 2009), and also providing comfort and positive impact to the occupants and the environment through an effective combination of energy and water efficiency systems, indoor environmental quality (IEQ) systems, day lighting strategies and efficient building envelope system (Dalibi, 2012).

In other words, green building construction requires adapting the building and the site to such requisite like the site micro climate, site conditions, culture and community in order to reduce consumption of resources,

resource supply incorporation, and enhance the quality and diversity of life, while optimizing all these in an integrated design. In a nutshell, it is a total quality management approach to building so as to ensure the achievement of synergistic design through interdisciplinary teamwork ((Dahiru, et al, 2013); To achieve synergy in green building, all the professionals that would be involved in the planning, design and construction of such building must be brought early (at the design stage), for professional input in the design of green building from the beginning to undertakes site analysis and environmental impact assessments (Dahiru, et al., 2014). Green building projects design and construction is new in Nigeria as a whole and is characterized by the problem of lack of shared perception and agreement on the objectives and success/failure of the green building projects by stakeholders (Dalibi, et al., 2016); also different set of criteria for success/failure for the project (Kumo & Hassan, 2012). As such, each stakeholder perceives the success according to a hierarchy of dimensions, which comply with their personal agenda. The initial emphasis of sustainability was on technical issues such as materials, building components, construction methodologies and energy related design concept (U. S. GBC, 2012). But recognition of non-technical issues economic and social sustainability concerns and cultural heritage of the built environment as being equally important (Abolore, 2013). According to (Shelbourn, et al., 2006), sustainable world progress is dependent upon continued economic, social, cultural, and technological progress. (Nuruddeen, & Gidado, 2015) reported that these four main factors; economic, social, cultural and technological factor, each is found to have a significant effect towards adopting green building technology.

However, every project or development comes with its unique benefits, challenges and factors that hindered its success; green building developments in Nigeria are not an exception. “To be sustainable, buildings should usefully last for many generations, this requires some knowledge of the future climate and the resources available to maintain the operations, in particular the energy consumption, of buildings” (Byrd & Leardini, 2011). Industry professionals, in both the design and construction disciplines, are generally slow to change, tend to be risk-averse, lack sound knowledge, experience, and understanding of how to apply ecology to construction design; moreover, environmental or economic benefit of some green building approaches has not been scientifically quantified (Zhiyong, 2013).

The awareness of green building by the general public will form the market-driven power for such developments especially in the urban area. However, the difficulties include: Lack of basic data of using green building assessment system, Lack of professionals, Lack of interest from real estate developers and difficulty of having a unified green building assessment standard among others (Qian, 2008). Building materials have been playing an important role in the construction industry; no field of engineering is conceivable without their use (Akanni, et al., 2010). A report of UNCHS (1993) found that building materials remain the most significant input in project development; however, with green buildings, most of the material components are not locally produced/ manufactured in Nigeria example is solar panels, switchable glazing, water conserving appliances and grey water systems etc. (Ibn-Homaid, 2002; UN Centre for Human Settlement, 1993). Despite all these glaring challenges and drastic measures, green buildings developments and sustainable practices are embraced very slowly and practiced at slow pace in the Nigeria’s construction industry. This is worrisome and may be due to some factors affecting the sustainable practices within its built environment. Such factors may also be attributed to project stakeholders or the concept itself (Dalibi, 2017).

Therefore, considering the necessity, this study highlights some future prospects of green building in Jos metropolis plateau state capital, Nigeria as how the systematic implementation of green building concept can be able to achieve sustainable urbanization in the city. The study attempts to identify, examine and assess some of the problems and prospects of the concept of green building in the city based on the project professionals’ perceptions with a view of exposing the impacts of such hindrances on the city’s built environment and of course Nigeria at large. In addition, the study also tries to discuss how green building can become cost effective and how can it become the panacea of global warming. If we are able to take proper initiative to growth of green building then green building can become the most important technique of environment friendly urbanization in Nigeria. Therefore, the green building concept has utmost importance to provide enough protection to our earth from global warming as well as it became the path of sustainable development.

1.1 The Study Location

The investigated area is Jos metropolis. It lies within latitudes 9°45’00’’N to 09°57’00’’N and longitudes 8°48’00’’E to 8°58’00’’E. Jos is the administrative capital of Plateau state in the North-central geopolitical zone of Nigeria. The study areas for the green building developments are parts of Jos North and Jos South Local Government Areas (LGAs) where construction activities are taking place very fast due to economic, social and population growth. Jos North and South have population of 429,300 and 306,716 respectively based on the 2006 National Census. Jos metropolis covers an area of 249.7km². At an altitude of 1,217m (3,993ft) above sea level, Jos enjoys a more temperate climate than most of the rest of Nigeria. The climate is the wet and dry type classified as tropical rainy climate and characterized by a mean annual rainfall of 1,250mm, peaking between July and August. The mean annual temperature is about 22°C but mean monthly

values vary between 19°C in the coolest month of December and 25°C in the hottest month, April. The city of Jos is the largest settlement in Plateau State. It owes its origin to the introduction of Tin mining on the Jos Plateau and railway lines linking it with Port Harcourt and Lagos, thus bringing the area into the orbit of the world economy. Tin mining led to the influx of migrants, mostly Hausas, Ibos, Yoruba's and Europeans who constitute over half of the population of the town, making it highly cosmopolitan (Adzandeh, et al., 2015).

II. THE RESEARCH METHODOLOGY

Journals, conference/seminar/workshop papers, textbooks, and internet sources etc. were used as secondary sources of data to review literature on the area pertaining to green building, which helps in identifying and narrowing the various factors hindering green building as well as the benefits/prospects of building developments in Jos metropolis. These identified hindrances and prospects form the main body of the Questionnaire which was distributed manually to lecturers in higher Institutions and various professionals practicing in Jos. A 4-point scale Questionnaire was designed as; strongly agree, agree, disagree, and strongly disagree and used to obtain the various perceptions respondents. A total of 50 questionnaires were distributed, out of which 37 were returned and used for the analysis.

Relative importance index was used to determine the hindrances and benefits (prospects) of green building (sustainable) construction in Jos, the plateau state capital. The four point scale was converted to Relative importance index (R.I.I) for each factor, which is made possible to compare the relative importance of each of the factor as perceived by the respondent. The Relative importance index (R.I.I) was formulated using the following statistical expression (Lim, & Alum, 1995);

$$R.I.I = (4n_1 + 3n_2 + 2n_3 + n_4)/4N$$
$$0 \leq (R.I.I) \leq 1$$

The respondent rated each factor on scale 1 – 4. The average of 37 well completed returned questionnaire retrieved formed the data in which the study is based. The data were analyzed by the Relative Importance Index(R. I. I.);

$$R.I.I = (4n_1 + 3n_2 + 2n_3 + n_4)/4N$$

Where:

- n₁ = Number of respondent for strongly agree;
- n₂= Number of respondent for agree;
- n₃= Number of respondent disagree;
- n₄ = Number of respondent for strongly disagree; and
- N = number of respondents.

III. DATA PRESENTATION, ANALYSIS AND RESULTS

3.1 Results of Administered Questionnaires

The Primary data for this research work was obtained through manually distributed questionnaires to those in the academia and other construction professionals practicing in Jos and the responses obtained were presented in charts and tables.

Tables 1 and 2 present the findings pertaining to the number of distributed/returned questionnaires and the responses by professionals in tertiary institutions and built environment within the Jos metropolis. Fifty (50) Questionnaires were administered out of which thirty seven (37) were properly completed and returned. This puts the response rate at 74% which is above average; thus the response rate is good. The Civil engineers have the highest total responses of 100%, followed by Architects at 83.0%, Builders 80%, Quantity surveyors 40% and Land surveyors 40%; while Town planners have the least with 37.5%. This is also illustrated in the chart in Figure 2.

Figure 3(a) represents the chart of the findings establishing whether there are serious side effects of developmental activities in the environment, hence the need for the practice of green building in Jos metropolis. The result revealed 89% of respondents were of the view that conditions calling for the use of green building do exist in Jos while only 11% said "No". This clearly indicates that there is need for measures to be taken in order to mitigate this problem. On the other hand, Figure 3(b) represents the chart indicating the level of respondents' knowledge on the existence of Environmental Impact Assessment (EIA) legislation in Nigeria. From the findings, 73% of the respondents had no idea of the existence of EIA compared to only 23% having knowledge of it, clearly indicate that even professionals in the built environment are ignorant of this important factor.

Table 3 presents the assessment of factors hindering the developments of green building. On a scale of 1 to 4, ranging from "strongly disagree" to "strongly agree" based on the (R.I.I). The respondents strongly agreed that "builders/developers preference to conventional methods of construction" is the major hindrance to green building developments in Jos metropolis; as it ranked the highest among other factors. Factors such as, the "lack of green building awareness", market expectation of green building developments among stakeholders, lack of green building technical know-how, were also agreed as top hindrances to green building development in

the city as were 2nd, 3rd and 4th highest ranked by the respondents. However, the green building hindrances with least impact on green building developments in Jos metropolis as agreed by the respondents are; “no enabling environment for green building development” (5th), hindrance due to the cultural, economic, social and technological (CEST) barriers (6th) and lastly, “inadequate professionals to handle the task” (7th).

Table 4 presents the responses on the benefits/prospects that will be derived from green building if adopted in Jos metropolis. Also, on a scale of 1 to 4, ranging from “strongly disagree” to “strongly agree” and based on the (R.I.I). “Helping in preserving natural resources”, is ranked first, indicating that the respondents have strongly agreed that preservation of natural resources is the highest among other prospects of green building developments in Jos and closely followed are; health, productivity/social gains”, “economic and financial benefits and benefits in terms of market free pass and product differentiation. Then other factors are “reduced energy consumption”, “opportunities for both employers and employees ranked”, “reduced capital cost ranked” while “reduced operating cost and “total satisfaction from doing the right thing,” were ranked the least.

However, with respect to the immediate and future implications of these research findings to the case study’s built environment, all of the factors analyzed for both the problems and prospects of green building construction in Jos metropolis are important and necessary in achieving the overall goal irrespective of the R.I.I rankings. The factors (problems and prospects) are peculiar to establishing green building constructions methods anywhere especially in Nigerian context. Thus, whether these findings are to be taken into consideration for green building construction implementation in Jos, now, later or in near future, the concept is about achieving sustainable development goals.

Table 1: Distribution of Questionnaires

Number distributed	50
Number properly completed and returned	37
Percentage (%)	74

Source: Authors’ field work

Table 2: The Questionnaires Responses by Professional Disciplines

S/No.	Profession	Distributed	Returned	Percentage of Response (%)
1.	Architects	12	10	83.3
2.	Builders	10	8	80
3.	Civil Engineers	12	12	100
4.	Land Surveyors	5	2	40
5.	Town planners	8	3	37.5
6.	Quantity Surveyors	5	2	40
7.	Total	50	37	-

Source: Authors’ field work

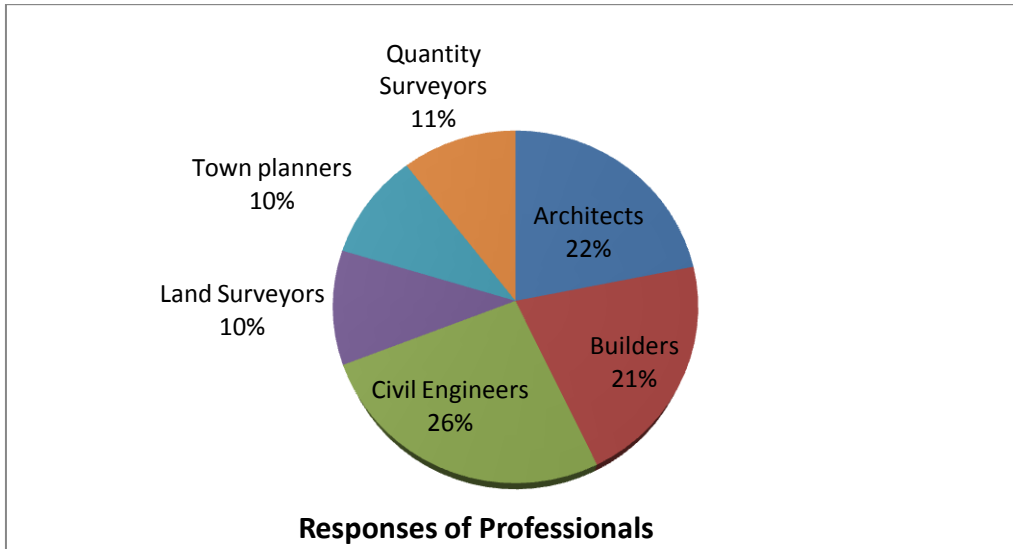


Figure 2: Professionals Responses to Questionnaire

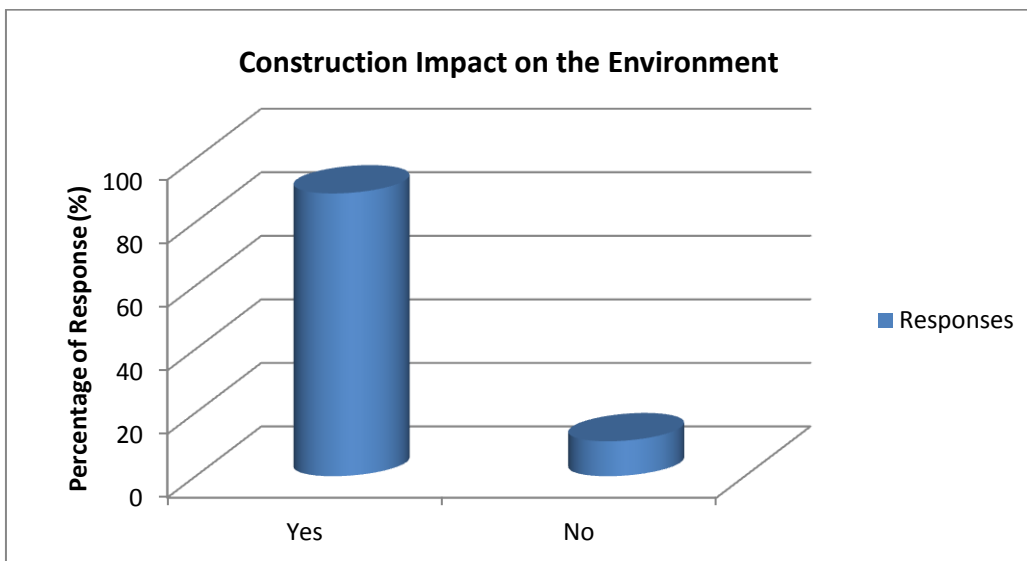


Figure 3(a): Respondents Impact of Construction on the Environment

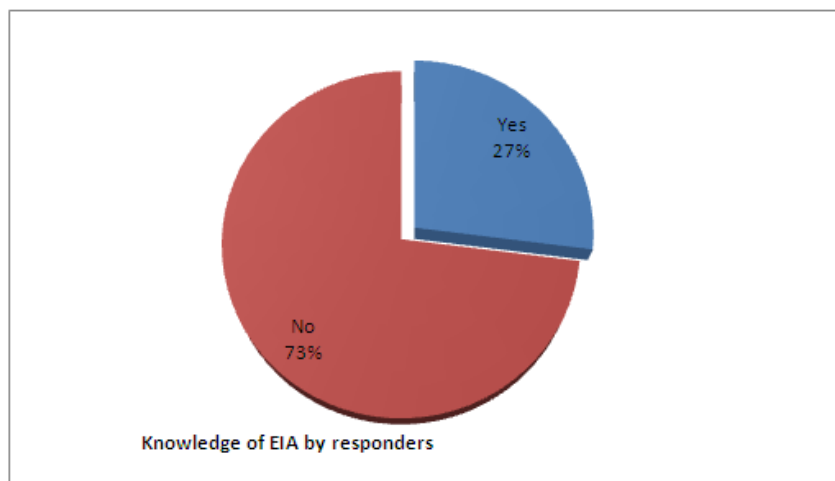


Figure 3(b): Respondents Environmental Impact Assessment

Table 3: Respondents Assessment of Factors Hindering the Developments of Green Building

S/no.	Factors	Responses				N	R.I.I	Rank
		n ₁	n ₂	n ₃	n ₄			
1.	Builders/Developers preference to conventional methods of construction	16	14	6	1	37	0.8041	1 st
2.	Cultural, economic, social and technological (CEST) barriers	12	9	8	8	37	0.5676	6 th
3.	Lack of green building awareness	19	10	4	4	37	0.7973	2 nd
4.	Lack of technical know-how	9	9	9	10	37	0.6148	4 th
5.	Inadequate professionals to handle the task	8	8	6	15	37	0.5608	7 th
6.	Market expectation of green building developments among stakeholders	10	9	14	4	37	0.6689	3 rd
7.	No enabling environment in terms of legislations/policies	7	8	12	10	37	0.5810	5 th

Table 4: Respondents Assessment of Benefits Derived From Green Building (Prospects)

S/no.	Factors	Responses				N	R.I.I	Rank
		n ₁	n ₂	n ₃	n ₄			
1.	Opportunities for both employers and employees	20	6	7	3	37	0.7770	6 th
2.	Health, Productivity And Social Gains	25	10	2	0	37	0.9054	2 nd
3.	Economic and Financial Benefits	22	12	2	1	37	0.8716	3 rd
4.	Reduced Capital Cost	18	7	8	4	37	0.7635	7 th
5.	Reduced energy consumption	21	5	9	2	37	0.8040	5 th
6.	Reduced Operating Cost	15	8	12	2	37	0.7432	8 th
7.	Benefits in terms of Market free pass and product differentiation	23	4	6	4	37	0.8108	4 th
8.	Preserving Natural Resources	32	5	0	0	37	0.9662	1 st
9.	Satisfaction in doing what is right	15	9	10	3	37	0.7432	8 th

IV. CONCLUSION AND RECOMMENDATIONS

The study found that:

- i. Based on the responses received from the various professionals especially in the built environment involved in this study, the need for green buildings exists in Jos Metropolis.
- ii. The perceptions of the respondents in Jos metropolis built environment indicate that, amongst the various problems of green (sustainable) building, outlined in a study, the most important one militating against the practice of green building in the city, are; Builders/developers preference to conventional methods of construction, lack of awareness and Market expectation of green building developments among stakeholders.
- iii. All the prospects of green building practice in Jos metropolis outlined in the study were seen as very important. However, the most important benefits based on the responses gathered in this study are; preserving natural resources, followed by Health and productivity gain, and Economic and Financial Benefits.
- iv. Public enlightenment should be conducted by the government, Non-Governmental Organizations, and professional bodies in order to spread awareness pertaining green (sustainable) construction practices in Jos and Nigeria at large.
- v. The practice of Green building should be encouraged by the government; request for construction environmental management plan from contractors as part of tender documents and the government should liaise with the industry's stakeholders to establish a construction bank that will empower the people.
- vi. Legislation and/or policy on Green Building practice should be formulated, though the responses from the various professional who responded to the questionnaire in this study revealed that majority had knowledge of green (sustainable) construction, however, for the benefit of the general public, such move is highly required.

REFERENCES

- [1]. Abolore, A.A. (2013). Comparative Study of Environmental Sustainability in Building Construction in Nigeria and Malaysia, journal of Emerging trends in Economics and Management Sciences, 3 (6): pp. 951 – 961.
- [2]. Adzandeh, E.A., Akintunde, J.A., & Akintunde, E.A., (2015). Analysis of Urban Growth Agents in Jos Metropolis, Nigeria, International Journal of Remote Sensing and GIS, 4(2), pp. 41-50 ISSN 2277–9051.
- [3]. Akanni, P.O. (2006). Small Scale Building Material Production in the Context of the Informal Economy, the Professional Builders, pp. 13 – 18.
- [4]. Building Design & Construction (BD&C), (2003). White Paper on Sustainability: A Report on the Green Building Movement, Building Design and Construction Supplement.
- [5]. Byrd, H & Leardini, P., (2011). Green Buildings Issues for New Zealand, "Procedia Engineering", 21, pp. 481 – 488.
- [6]. Carmona, A., Isabel & Tadj, O., (2004). "Architects Need Feedback on Environmental Performance". Building Research and Information, Jul-Aug 2004, Vol. 32 (4).
- [7]. Dalibi, S. G., Feng, J. C., Liu, S., Abubakar, S., Bello, B. S & Danja, I.I. (2017). Hindrances to Green Building Developments in Nigeria's Built Environment: "The Project Professionals' Perspectives" 2017 International Conference on Environmental and Energy Engineering (IC3E 2017) IOP Conf. Series: Earth and Environmental Science 63 (2017) 012033
- [8]. Dalibi, S. G., Hadiza, B & Mai-Auduga, J. B., (2016). Green Buildings: A Concept aligning the interests of Stakeholders (Developers/Clients and End-users) in Estate Development Projects in Abuja - F.C.T (Federal Capital Territory), Nigeria. SBE16 Hamburg: Strategies – Stakeholders – Success factors. International Conference on Sustainable Built Environment in Hamburg, Germany, 7 - 11th March, 2016.
- [9]. Dalibi, S. G & Kumo, H.A. (2016). Success Criteria for Green Building Projects in the Nigeria's Construction industry: "The Stakeholders' perception". SBE16 Hamburg: Strategies – Stakeholders – Success factors. International Conference on Sustainable Built Environment in Hamburg, Germany, 7 - 11th March 2016.
- [10]. Dalibi, S. G. (2014). Green Buildings: The Clients' & the End Users' Common Ground in Environmental Sustainability. Nigerian Institute of Quantity Surveyors (NIQS), National Training Workshop, in Uyo, Akwa Ibom State of Nigeria, 9 – 11th October, 2014.
- [11]. Dahiru, D., Dania, A. A. & Adejoh, A., (2014). An Investigation into the Prospects of Green Building Practice in Nigeria, Journal of Sustainable Development, 7(6); 2014 ISSN 1913-9063 E-ISSN 1913-9071.
- [12]. Dahiru, D., Bala, K & Abdul'Azeez, A. D., (2013). Professionals' Perception On the Prospect of Green Building Practice in Nigeria, SBE 13: Creating a Resilient and Regenerative Built Environment, 15-16th October, 2013, Cape Town, South Africa.
- [13]. Dalibi, S. G. (2012). Cost Impact Assessment of Green Buildings in China (A Case Study of Few Selected Green Building Projects in Shanghai, China). Msc Thesis submitted to Hohai University Nanjing – Jiangsu Province of China.
- [14]. ENSAR Group (2003). Sustainable Federal Facilities Task 2.1 Business Case. November, 2002 workshop notes. Boulder, Co.
- [15]. Environmental Protection Agency (EPA), Green Building, available at <http://www.epa.gov/greenbuilding/pubsabout.htm>.
- [16]. Greg Kats (2003). "The cost and financial benefits of green building" – A report to California's Sustainable building task force.
- [17]. Gunajit, S (2017). "Problem, Progress and Prospect of Green Building as a means of Sustainable Urbanization with special reference to Guwahati City of Assam" IOSR Journal Of Humanities And Social Science (IOSR-JHSS) Volume 19, Issue 8, Ver. I (Aug. 2014), PP 64-67 e-ISSN: 2279-0837, p-ISSN: 2279-0845.
- [18]. Ibn-Homaid, N.T., (2002). A Comparative Evaluation of Construction and Manufacturing Materials Management," International Journal of Project Management, 20, pp. 263 – 270
- [19]. Kumo, H.A. (2012). Perception of stakeholders on success criteria for World Bank water supply projects in Kaduna state – Nigeria. MSc thesis submitted to Department of Building Faculty of Environmental Design Ahmadu Bello University, Zaria, and Kaduna State –Nigeria.
- [20]. Lim, E.C., & Alum, J., (1995). Construction productivity: issues encountered by contractors in Singapore. International Journal of Project Management, 13 (1), 51–58.
- [21]. Nuruddeen, U & Usman, M. G., (2015). An Assessment of the Factors Affecting Green Building Technology (GBT) Adoption, WASET 18th IC Jeddah Saudi Arabia Jan 26-27, 2015, 13 (01) Part XIII.
- [22]. Qian, S, (2008). Strategies of Implementing a Green Building Assessment System in Mainland China, Journal of Sustainable Development, 1(2), Available at www.ccsenet.org/journal.html.
- [23]. Shelbourn A., Bouchlaghem, D. M., Anumba, C. J., Carillo, P. M., Khalfan, M. M. K & Glass, J., (2006). IT cons Vol.11 (2006), available at <http://itcon.org/2006/4/> pg. 57.
- [24]. Udosen, J.U. & Akanni, P. O., (2010). A Factorial Analysis Of Building Material Wastage Associated With Construction Projects. Journal of Civil and Environmental Systems Engineering, 11(2), pp. 81-90.
- [25]. United Nations Centre for Human Settlement (1993). Building materials for housing: Appropriate intermediate, cost effective building materials, technology and transfer mechanism for housing delivery. Retrieved from <http://ww2.unhabitat.org/>
- [26]. U.S. Green Building Council, How to achieve certification, Accessed: February 21 2012, Available: <http://www.usgbc.org/Display-Page.aspx?CMSPageID=1991, 2012. Programmes / housingpolicy / documents / HS.C.14.7.htm>
- [27]. Zane Satterfield, P. E. (2009). Tech Brief On Green Building Published By: The National Environmental Services Centre (Winter 2009), Vol. 8, Issue 4 Tech Briefs.
- [28]. Zhiyong, W. (2013). New Cost Structure Approach In Green Buildings: Cost-benefit analysis for widespread acceptance and long-term practice. Submitted to the System Design and Management Program in partial fulfillment of the requirements for the degree of Master of Science in Engineering and Management at the Massachusetts Institute of Technology January 2013

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