

Organizational Factors Affecting the Usage of Sustainable Building Materials in the Nigerian Construction Industry

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Abstract

The practice of sustainability in construction is paramount to the preservation of the built environment which is lacking in Nigeria. The study seeks to identify the organizational factors affecting the use of sustainable building materials in the Nigerian construction industry from the perception of the contractors and professionals. A survey research was conducted for data collection with a structured questionnaire between thirty (30) professionals and thirty (30) contractors. The data collected was analyzed with both descriptive and inferential statistics. The study shows that lack of awareness and knowledge of construction personnel, cost and economic viability, passive culture or norm, top management commitment, organizational goal and objectives were the internal organizational factors militating against the practice. While the external factors militating against the practice were research and development, Knowledge and skill of personnel, learning period, and local authority and government. The hypotheses revealed that there is no agreement between the internal factors affecting the contractors and professional firms on the practice. But there is an agreement between the external factors affecting the two types of firms. The study reveals the factors that militate against the practice of sustainability, this will allow the stakeholders to focus on the cogent issues to encourage and sustain the practice within an organizational level. The practice will benefit the built environment and the eco-system through the preservation of natural resources.

Keywords: building materials, contractors, organizational factors, professionals, sustainable

INTRODUCTION

The construction business is the biggest raw materials, consumer of any society. Kasai (1998), estimates that construction consumes about 50% of the total material consumption in Japan. The processing of the raw materials into goods and its movement to the point of usage require an extensive amount of additional resources and results in significant environmental loads. The process of utilization of global natural resources in the past has placed a tremendous strain on the environment-endangering our biodiversity, polluting the environment, depleting our natural resources, warming the earth, and raising sea levels. The result of the global natural resources is climate change. According to the United Nations, cities consume two thirds of global energy use. 76% of the world's energy-related carbon dioxide (CO₂) is also emitted by cities through building and construction related activities, industry, and transport.

The practice of sustainability in the construction industry depends on the decisions taken by a number of actors in the construction process: owners, managers, designers, firms, governments and so on. The practice of sustainability depends on the awareness, knowledge as well as an understanding of the consequences of individual actions (Braganca et

al, 2007; Abidin, 2010). Understanding the environmental issues surrounding the extraction of raw materials, the manufacture of construction materials, and their effects in use, is important to ensure sustainability (Ofori et al, 2000).

The state of the built environment in Nigeria is a National menaced due to the activities of the construction industry and other sectors. The Nigerian construction industry itself is characterized by fragmentation- enmeshed in personal struggles for power and superiority rather than the essence of the industry- the built environment, the products are mainly based on policies and programs rather than plans and processes (Olaseni 1999; NISER 2001; Obiegbu 2001; NIOB 2005). Most government policies and programs failed because they are not well planned and implemented. These have led to environmental degradation-depletion, damage or destruction of potentially renewable resources like, soil (borrow pits) for road construction and land reclamation, forest for timber and so on, resulting in erosion, desertification, deforestation, salination of irrigated land, flooding and so on.

The concept of sustainability in the built environment has been the choice of construction stakeholders across the world in order to tackle the environmental

impact of building and construction related activities. Nevertheless, the development and implementation of sustainable construction in Nigeria are still lagging behind or a mirage. Though it can be achieved, but its actualization is confronted with lots of challenges both of internal and external factors within and around the industry

It is more paramount than to look at the concept of sustainability in the Nigerian construction industry, which is mostly driven by the contractors and the professionals. Hence, the study seeks to identify the organizational factors that militate against the use of sustainable building materials in the Nigerian construction industry from the perception of both the contractors and the professionals in the industry.

Building Materials and Sustainability

Building materials play an essential role in achieving the sustainability of the building. The usage of building materials has a substantial impact on the environment, because of the large quantity of non-renewable resources with the potential for depriving future generations of their use (Ofori 2002; Godfaurd et al, 2005). Thus, all building materials, directly or indirectly affect the environment during their life cycles. Basically from the extraction process of the raw materials, usage and demolition, different forms of pollution are caused, with adverse effect on the environment.

Construction Stakeholders have begun to focus more to the controlling and correcting the negative impact of construction activities on the environment. Major concern is the selection of materials, which before was determined by cost, appearance, availability and ease of use. Sustainability concept has broadened the factors for material selection these days, according to Asif et al 2007, environmental suitability of materials is also an important factor that is acknowledged by construction Stakeholders.

Sustainable Building Materials

The research into environmentally friendly production has widened in scope in recent year. Ofori (1999) note's that several factors account for this, including the efforts of professional institutions to enhance the awareness of their members through publications of policy documents and best practice guides on materials selection. Sustainable building materials: respect the limitations of non-renewable resources, work with the pattern of nature's cycles, and inter- relationships of ecosystems, are non-toxic, are energy and water efficient, are made from recycled materials and they are recyclable (Huberman & Pearlmutter, 2008).

Sustainable materials should exhibit certain characteristic as cited by Kibert and Bosch (1998):

- I. Acceptable levels of environmental performance characteristics should be determined.
- II. All aspects of materials entire life cycle should be considered
- III. No permanent environmental contamination should occur during the material life.
- IV. Materials should not be combined into compositions which cannot be disassembled.
- V. The material production and application should be energy efficient.
- VI. Third party certification for some product is desirable.
- VII. They are often more affordable than commonly perceived.
- VIII. They provide improved indoor air quality.
- IX. Deconstruction after building use should be possible.

Factors Militating Against the Use of Sustainable Building Materials

The use of sustainable building materials in the construction industry still faces a lot of challenges for its implementation. Based on the studies of Landman (1999), Anderson et al, (2000), Rao and Brownhill, (2001), they noted the factors militating against the use of sustainable building materials as follows:

- I. The real or perceived financial cost and risks which include the problem of the upfront cost and the ongoing costs usually coming from separate budgets, if not separate organizations.
- II. The lack of information and training of designers, contractors, and clients.
- III. Lack of demand from the clients.
- IV. Lack of support from subcontractors.
- V. Regulation

All these factors are more of organizational – related issues. An organization is subjected to both internal and external factors which influence the organizational environment and how the management of such organizations respond to it. Internal factors relate to the strength within the construction organization system which indicates its readiness and capability to pursue or practice sustainable construction organization system. This indicates its readiness and capability to pursue or practice sustainable construction by employing sustainable materials in construction purpose. The challenges within organizations, according to Abidin (2010) are:

- I. Lack of awareness and knowledge of developers
- II. Size of developers organization
- III. Interest, direction and commitment of top management
- IV. Cost versus economic viability
- V. Target buyers
- VI. Passive culture

External challenges refer to challenges not within the organization, beyond the direct control of the

construction industry organizations that impose certain restrictions or limitation towards the development of sustainable material usage implementation in the industry. Abidin (2010) highlighted the challenges as:

- I. Local authority’s and government’s involvement
- II. Public interest and Buyers demand
- III. Status quo in rules and regulations
- IV. Availability of green materials
- V. Learning period
- VI. Associating sustainable concept with luxury living

RESEARCH METHODS

To achieve the aim of the study, a survey research approach was selected. A structured questionnaire was designed as instrument for data collection from 60 respondents; consisting of 30 building contractors and 30 professionals in the construction industry. The data collected were analyzed using both descriptive and inferential statistics. The mean score is used to rank the internal and external factors affecting the use of sustainable building materials and also its characteristics. Regression analysis and t-test was used to test the hypotheses to establish if there is an association between the perspective of the contractors and construction professionals on the factors affecting then use of sustainable building materials.

ANALYSIS OF DATA AND DISCUSSION OF FINDINGS

According to Table1, 30 (50%) of the respondents were contractors while 30 (50%) were professionals in the construction industry. Multinational and indigenous contractors were 9 (15%) and 21 (35%) respectively. 6 (10%) were foreign trained professionals and 24 (40%) were locally trained professionals. 19 (31.7%) of the contractors were involved in building works and 11 (18.3%) engage in civil works. On the side of the professionals, 8 (18.3%) practice of architecture, 5 (8.3%) in M & E engineering; those in consultancy and manufacturing/ production were 10 (16.7%) and 7 (11.7%) respectively.

Table 1: Shows the characteristics of respondents

Respondents	Frequency	Percent
Specialization		
Contractors	30	50.0
Professional	30	50.0
Company Status		
Multinational Contractors	9	15.0
Indigenous Contractors	21	35.0
Foreign trained Professionals	6	10.0
Locally trained Professionals	24	40.0
Line of Business		
Contractors		
Building work	19	31.7
Civil work	11	18.3
Professionals		
Architectural work	8	13.3
M & E engineering	5	8.3
Consultancy	10	16.7
Manufacturing / Production	7	11.7

Recycled content was rated low by both respondents with 1.25 for the contractors and 1.22 for the professional ranking last as a characteristic of sustainability of building materials used in the construction industry. The respondents agreed that the level of usage of embodied energy materials is high according to Table 2. The usage of recyclable materials was also rated low by the contractors (1.45) and the professionals (1.40). Durability of materials used in the industry was accepted to be on an average of the respondents with (2.47) and (2.32) for the contractors and professionals respectively.

Table 2: Sustainability characteristics of building materials used

Sustainability characteristics	Contractors		Professionals	
	Mean	Rank	Mean	Rank
Recycled Content	1.25	5	1.22	5
Recyclable materials	1.45	4	1.40	4
Reusable materials	2.12	3	2.31	3
Low embodied energy materials	2.81	1	2.65	1
Durable materials	2.47	2	2.32	2

Note; the mean is based on a Likert scale of (a) High (3) (b) Average (2) (c) Low (1)

From Table 3, it can be seen that the level of practice of sustainability of building material manufacturing, processing, and usage is low. According to the respondents, 24 (80%) of the contractors agreed that the practice is low and also the professionals agreed that the use of sustainable building materials is low in the construction industry with 28 (93.3%).

Table 3: The level of practice of usage of sustainable building materials

Variables	Contractors		Professionals	
	Frequency	Percent	Frequency	Percent
Low	24	80.0	28	93.3
Average	4	13.3	2	6.7
High	2	6.7	0	0.0
Total	30	100	30	100

Table 4 shows that top management commitment (4.00) is a vital factor that affects the use of sustainable building materials in the construction industry according to the contractors. The professionals agreed that the major significant factor is lack of awareness and knowledge of construction personnel (3.89). Organizational goal and objectives (interest) for the contractors (3.60) is very significant, while for the professional (3.02) is significant. Both respondents agreed that cost and economic viability is a very significant factor militating against the use of sustainable building materials in the industry with a mean score of 3.53 and 3.67 for both the contractors and the professionals respectively. The professionals agreed that passive culture or norm is a very significant factor, but the contractors agreed that it is not a significant internal factor affecting their decision in using sustainable building materials.

Target buyers (the client’s) for the professionals is (2.72) and the contractors is (2.54) mean score and it is a significant factor for both respondents. The contractors agreed that their firm size is not significant to the decision of sustainability of building materials. But the professionals agreed that the size of firms still affects the use of sustainable building materials in a way.

Table 4: Factors that affect the usage of sustainable building materials

Challenging factors that affect the usage of sustainable building materials	Contractors Mean Rank	Professionals Mean Rank
Internal challenges	2.79	3.12
Lack of awareness and knowledge of developers	3.21	3.89
Size of firm	1.21	1.82
Organization goal and objectives (interest)	3.60	3.02
Top management commitment	4.00	3.07
Cost and economic viability	3.53	3.67
Target buyers (clients)	2.54	2.72
Passive culture or norm	1.42	3.57
External Challenges	2.82	3.17
Local authority and government	3.29	3.61
Client organizations	2.38	3.51
Public interest	2.05	2.45
Availability of green materials	2.02	2.34
Research and development	4.00	4.00
Knowledge and skill of personnel	3.75	3.97
Learning period	3.01	3.81
Status quo in rules and regulation	2.09	1.67

Note: Mean is based on a Likert scale of Very significant (4), Significant (3), Less significant (2), Not significant (1).

The external factors that majorly affect the use of sustainable building materials according to the two groups of respondents were research and development and knowledge and skill of personnel. Further, the professional rate client’s organization (3.51) as a very significant external factor while the contractors regard it as a less significant factor (2.38). The professionals and the contractors rated local authority and government as a significant factor. The two respondents agreed that the status quo in the rules and regulation is a less significant factor influencing the use of sustainable building materials. In addition, the external factors have more predominance on the decision of both the contractors and professionals in the decision of sustainability of building materials than the internal factors according to Table 4. Two hypotheses (**H₁** and **H₂**) are developed to study the relationship between the two types of respondents, how they are affected by internal and external factors.

H₁: There is no association between the internal factors challenging the practice of the concept of sustainability of building materials as perceived by the contractors and professionals.

Table 5: Spearman rank correlation coefficient of the association between the internal factors challenging the use of sustainable building materials

Variable	R	DF	T cal	T tab	Decision
Internal factors	0.321	5	0.75	2.015	Accept Ho

At **0.05** levels of significance and degree of freedom of **5**, **T_{cal} = 0.75** and **T_{tab} = 2.015** since **T_{cal} < T_{tab}**, **H₀ is accepted**. Therefore, there is no association between the internal factors challenging the practice of the concept of sustainability of building materials as perceived by the contractors and professionals.

H₂: There is no agreement between the external factors challenging the use of building materials as perceived by the contractors and professionals.

Table 6: Spearman rank correlation coefficient of agreement between the external factors challenging the use of sustainable building materials

Variable	r	Df	T cal	T tab	Decision
External Factor	0.97	6	5.87	2.13	Reject Ho

At **0.05** levels of significance and degree of freedom of **6**, **t_{cal} = 5.87** and **t_{tab} = 2.13** since **T_{cal} > t_{tab}**, **H₀ is rejected**. Therefore, there is an agreement between the external factors challenging the practice of the concept as perceived by the contractors and the professionals.

DISCUSSION OF FINDINGS

The findings of the study show that the level of the practice of the concept of sustainability of building material is low as perceived by the contractors and the professionals in Lagos State. This is due to the internal and external organizational factors militating against the practice. From the perception of the professionals, the study indicates that lack of awareness and knowledge of personnel’s and developers (internal factor) is a factor that affect the use of sustainable building materials as confirmed in Egan (2004) which indicated a problem at the level of knowledge and skills or both. Also, research and development (external factor) which have a direct influence on knowledge and skill is a vital factor affecting the two firms’ types this is in consonance with the study of Edwards (2006) and Lam et al (2010), that a lack of practical understanding of sustainability has hampered the effective implementation of the concept in the construction process. Further, the contractors believed that top management commitment (internal factor) also affects the practice.

Both the contractors and professionals, claims that the size of the firm has no implication on the choice of usage of sustainable building materials. This is in contrast to the study of Sharma, (2000) and Gunzalez-Benito (2006) that larger firms have more resource availability to devote to environmental

management and small firms may have more difficulties to adopt environmental friendly practices. Table 1 show that most firms are indigenous in nature and they may lack resources to sustain the practice of sustainability if Sharma's finding is considered. The study also identified lack of enactment and enforcement of law by the local authority and the government as a factor that affect the practice of sustainability in the construction industry. Regulation is vital to enhance the practice as indicated in Cabugueira (2004). The issue of learning period is also a major setback for the practice of sustainability according to the respondents. This may be due to the lack of interest in self development and continuous learning and improvement of the personnel's in the construction industry.

The study also indicates that the client influence the contractors and the professional firms both as internal and external factors, but the client has more impact on the professional organization than the contractors due to the fact that the professionals are more customer- focus than the contractors in practices. Also, Nigerian clients lack the awareness and education on sustainability issues as supported by Akadiri (2011).

Cost and economic viability consider as an internal organizational factor affecting the use of sustainable building materials by both respondents is consistent to Ofori and Kien, (2004) and Williams and Dair, (2007). The professionals believed that passive culture or norm as is an internal organizational factor affecting the practice, this result is in support of Williams and Dair (2006).

Top management commitment and organizational goal and objectives are also identified as an internal factor, according to the respondents and this characterized the organization's decision-making process whether to implement sustainability practice in their construction activities or not. In addition, the reason why the practice of the use of sustainable building materials is low, according to the contractors is the value their organization place on environmental issues, their value is geared towards profit-making in accordance to Akadiri (2011).

The contractors and the professionals need information about different kind of building materials, so as to be able to evaluate and select building materials during the design process this is in consonance with the study of Van Kesteren (2008), that selecting materials can be considered as a problem solving activity, in part because many new products of different qualities are entering into the market at an increasing pace and problem solving demands a large and constant flow of information. From Table 2, green materials are available for usage, but respondents believed that the available materials

still lack some sustainable characteristics such as recycled ability. The discovery and production of new sustainable building materials is an outcome of research and development in the construction industry, when this is lacking the practice of sustainability will be hindered. Also, if there is no constant flow of information about sustainability issues, knowledge, and skills of the stakeholder involved in the implementation of the practice is limited and decision-making will be difficult.

Furthermore, the study revealed that there is no association between the internal factors affecting the firms of both the contractors and the professionals. This is an indication that the internal factors within the contractor and professional organization differs from each other and impact the behavioral pattern of the management decision differently. Also, there is an agreement between the external factors affecting the firms which indicate that both the contractors and professional organizations respond to it's similarly. In addition, external challenges have more impact on the practice of the concept of sustainability of building materials in both the contractors and the professional firms than the internal factors.

CONCLUSIONS

The study focuses on the factors affecting the use of sustainable building materials in the Nigerian construction industry based on the perception of contractors and the professionals. The study revealed that the level of practice of usage of sustainable building materials is low. The major external factor affecting the practice is research and development. The internal factors militating against the practice were lack of awareness and knowledge of construction personnel, cost and economic viability and passive culture or norm based from the view of the professionals. The contractors agreed that the factors are top management commitment, organizational goal and objectives (interest) and cost and economic viability. The impact of external challenges affecting the practice as perceived by the respondents is more critical than the effects of the internal factors. Based on the study, knowledge and training of personnel become a critical issue in the implementation of the practice of sustainability of building materials in the construction industry. Lack of awareness and knowledge of personnel and research and development were basically knowledge-based challenges. Cost and economic viability and local authority and government were economic and legal- based challenges affecting the construction industry. Hence, the government should be pro-active towards the implementation of the policy that can enhance the practice of sustainability of building materials in the construction industry. Inferences from this study's result may not be generalisable due to sample size, characteristics of the study sample and study area (i.e. Lagos). The findings could serve

as a benchmark for the construction industry in Nigeria and future studies on the practice of sustainability.

REFERENCES

- Abidin, N. Z. 2010. Investigating the awareness and application of sustainable construction concept by Malaysian developers. *Habitat International*, 34 (4), 421-426.
- Akadiri, P. 2011. Development of a multi- criteria approach for the selection of sustainable Materials for Building Projects. A Doctor of Philosophy Thesis, University of Wolverhampton, UK.
- Anderson, S., Bennett, R. and Collopy, C. 2000. G-rated: Assessing the NEED for GREEN building design and construction sector survey results.' Office of Sustainable Development - GreenBuilding Division, Portland, Oregon.
- Asif, M., Muneer, T. and Kelly, R. 2007. Life cycle assessment: A case study of a dwelling home in Scotland. *Build Environ*, 42, 1391-1394.
- Braganca, L., Mateus, R. and Koukkari, H. 2007. Assessment of building sustainability, in Sustainability of Constructions, Integrated Approach to Lifetime Structural Engineering, Proceedings of the first COST C25 Workshop, Lisbon, Sept. 13–15, 2007, Ed. L. Braganca et al. Lisbon: Multicomp, 3–12.
- Cabugueira, M.F.M. 2004. Portuguese experience of voluntary approaches in environmental policy. *Management of Environmental Quality*, 15,174–185.
- Edwards, B. 2006. Benefits of green offices in the UK: analysis of examples built in the 1990s. *Sustainable Development*, 14 (3), 190–204.
- Egan, J. 2004. The Egan review: skills for sustainable communities. Office of the Deputy Prime Minister, London. http://www.odpm.gov.uk/Stellent/groups/odpm_urbanpolicy/documents/pdf/odpm_urbpol_pdf_028549.pdf.
- Godfaurd, J., Clements-Croome, D. and Jeronimidis, G. 2005. Sustainable building solutions: a review of lessons from the natural world. *Building and Environment*, 40 (3), 319-328.
- Gonzalez-Benito, J. and Gonzalez-Benito, O. 2006. A review of determinant factors of environmental productivity. *Business Strategy and the Environment* 15 (2), 87-102.
- Huberman, N. and Pearlmutter, D. (2008). A life cycle energy analysis of building materials in the Negev desert. *Energy and Buildings*, 40, 837-848.
- Kasai, Y. (1998). Barriers to the reuse of construction by-products and the use of recycled aggregate. Dhir, Henderson and Limbachiya Eds. Tomas Telford, 433-444.
- Kibert, C. and Bosch, G. 1998. Research information: green building materials' 96. *Building Research and Information*, 26 (3), 190–198.
- Lam, P. T. I., Chan, E. H.W., Poon, C. S., Chau, C. K. and Chun, K. P. 2010. Factors affecting the implementation of green specifications in construction. *Journal of Environmental Management*, 91 (3), 654-661.
- Landman, M. 1999. Breaking through the barriers to sustainable building – insights from building professionals on government initiatives to promote environmentally sound practices. MA thesis, Tufts University, Mass, USA.
- NIOB, 2005. Facilities management for sustainable building performance. A Technical Paper at the 2-days National Seminar organized by the Nigerian Institute of Building (NIOB) at Lafia, Nasarawa State.
- NISER 2001. ' NISER review of Nigerian development 2000. The State in Nigerian Development'. Nigerian Institute for Social and Economic Research (NISER), Ibadan, Nigeria.
- Obeigbu, M.E. 2001. Temporary works-design, construction, safety and inspection. A Technical Paper in the Proceedings of the 31st AGM/Conference of the NIOB, at Port-Harcourt, 1st- 5th August 2001. Paper No. 4.
- Ofori, G. 1999. Satisfying the customer by changing production patterns to realize sustainable construction, in Proceedings of the Joint Triennial Symposium of CIB Commissions W65 and 55, Cape Town, 5–10 September, 1, 41–56.
- Ofori, G. 2002. Singapore construction: moving towards a knowledge-based industry. *Building Research and Information*, 30 (6), 401-412.
- Ofori, G. and Kien, H.L. (2004). Translating Singapore architects' environmental awareness into decision making', *Building Research & Information*, 32: 1, 27 — 37.
- Ofori, G., Briffett, C., Jung, G. and Ranasinghe, M. 2000. Impact of ISO 14000 on construction enterprises in Singapore. *Construction Management and Economics*, 18, 935-947

Olaseni, A.M 1999. Urban and regional planning in Nigeria: A collection of Reading. Publication of the Nigerian Institute of Town Planners, Lagos State Chapter. Publishers the Research and Documentation Committee, Oct.1999.

Rao, S. and Brownhill, D. 2001. European green building forum 2 - green file. EU: Brussels..

Sharma, S. 2000. Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. *Academy of Management Journal* 43 (4), 681-697.

Van Kesteren, I. E. H. 2008. Product designers' information needs in materials selection. *Materials & Design*, 29 (1), 133-145.

Williams, K. and Dair, C. 2007. What is stopping sustainable building in England? Barriers experienced by stakeholders in delivering sustainable development. *Sustainable Development* 15, 135–147.