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ASSESSING BARRIERS TO SUSTAINABLE BUILDING MAINTENANCE PRACTICES IN SELECTED TERTIARY INSTITUTIONS IN KADUNA STATE

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ABSTRACT

Purpose: *Studies have shown that several barriers hinder the effective implementation of sustainable practices in building maintenance, despite considerable efforts to transition from conventional to sustainable building maintenance practices. Sustainable building maintenance is essential for minimising the environmental impact of buildings and ensuring their long-term sustainability. The aim of the study assesses barriers to sustainable building maintenance practice in selected tertiary institutions in Kaduna State, with a view to enhancing its adoption.*
Design/methodology/approach: *To achieve the aim of the study, opinions of the maintenance officers or operatives in selected tertiary institutions in Kaduna State were collected. The methodology was a critical exposition of related literature and a descriptive survey employing mean score, with relative ranking. A structured questionnaire was issued using a purposive sampling technique to a sample size comprising 53 maintenance operatives in the physical facilities units and maintenance departments of the selected tertiary institutions.*
Findings: *The results revealed that a lack of public awareness about the benefits of sustainable building maintenance practices and poor government policies in promoting Sustainable building maintenance practices are the key barriers to its adoption.*
Research limitations/Implications*: The study focused on only three tertiary institutions in Kaduna State (ABU Zaria, Kaduna Polytechnic, and Kaduna State College of Nursing, Kafanchan). This narrow coverage limits the generalizability of the findings to other Nigerian states, private institutions, or non-educational public buildings.*
Practical implications: *The study recommends that the adoption of the practice can be enhanced through educating and training building professionals on sustainable building concepts.*
Originality/value *– The study provides new empirical insight into the sustainability challenges within Kaduna State, Nigerian tertiary institutions, highlighting context-specific factors that differ from trends reported in developed countries.*

Keywords: Building, Barriers, Maintenance, Practice, Sustainability**.**

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1.0 INTRODUCTION

The construction industry globally is the most critical and leading carbon emitter (Huang et al., 2018), and this is attributed to the processes and products adopted in the conventional, traditional approach to building production. One of the largest contributors to the endangering of the environment, particularly the imbalance that threatens the safety of the next generations, is the built environment (UCL Energy Institute, 2015; UKGBC, 2009). An estimate of about 25% of the world's logging activities are carried out in the construction industry, carbon dioxide emission is about 39%, emitted sulphur dioxide is 49%, emitted nitrous oxide is 25%, extraction of raw materials is 40%, other matters emitted constitute 10%, particularly in industrialised countries (Lim et al., 2015).

Sustainable building, also known as green building, involves creating structures that are environmentally responsible and resource-efficient throughout their lifecycle. Sustainable building maintenance and green building practices are essential for reducing environmental impacts and promoting sustainable development. However, the adoption and implementation of green building practices face several barriers. This synthesis aims to identify and summarise the key barriers to sustainable building maintenance and green building adoption, as well as potential solutions to overcome these challenges.

There is a mismatch between the awareness level of Sustainable building maintenance practices and their adoption in developing countries. For instance, in Ghana, the demand for Green buildings is low (Addy et al., 2021) . In Nigeria, and by extension, other developing countries, the sustainable construction market is still largely under-tapped and unsaturated (Eze et al., 2023). Umar et al. (2021) reported that despite the growing local and international interest in sustainability, the level of awareness and knowledge of Sustainable building maintenance practices is still low amongst registered architects in Minna, Nigeria. According to Nikyema and Blouin (2020), developing countries in their efforts to implement sustainability agendas have always trailed developed nations as a result of various barriers. High initial cost and lack of financial incentives are significant barriers to green building adoption (Kineber et al., 2022). Insufficient information and awareness about green building benefits and practices hinder adoption (Liu et al., 2022). Significant obstacles to sustainable development come mainly from the lack of education, lack of awareness, lack of a standard Green Building tool, no financial incentives from the government and excessive concentration on capital cost over the operating cost (Addy et al., 2021). Limited technical expertise and knowledge about sustainable construction practices impede implementation (Kineber et al., 2022). Similar observations were also made in other studies in Africa (Mpakati-Gama et al., 2012; Nikyema and Blouin, 2020). In Singapore and Australia, lack of proper communication by Green Building teams, lack of green practitioners, high initial cost, lack of government support, lack of interest and market knowledge of Sustainable Buildings, uncertainty about sustainable building maintenance' benefits and performance, lack of building codes and regulations and poor relationships amongst stakeholders, were the major barriers to Sustainable building practices (Hwang and Tan, 2012). In the US construction industry, Darko et al., (2017) reported that the major critical barriers to the adoption of sustainable building technologies are: resistance to change from the use of traditional technologies, lack of knowledge and awareness of sustainable building maintenance and their benefits, high cost, lack of Sustainable building experts/skilled labour and lack of government incentives/supports. In the Australian construction sector, Gounder et al. (2023) examined the reasons for the low usage of sustainable materials for building maintenance projects, which include higher cost, possible cost overruns, lack of incentive, lack

of government policies on promoting Sustainable building maintenance practices and unwillingness to change at the industry level.

In Nigeria, research indicates that awareness and adoption of sustainable building practices are still low among industry professionals (Eze et al., 2023; Umar et al., 2021). However, little is known about the specific challenges faced by tertiary institutions, major owners and users of public buildings in Kaduna State, home to several long-standing academic institutions, which offer a unique setting to examine the barriers.

What are the factors that have prevented the sustainability market of these countries, especially as regards the use of Sustainable building maintenance practices in Kaduna State? A clear understanding of these factors will help shape decisions regarding the implementation of this practice. These barriers must be overcome by stakeholders to improve the incorporation of Sustainable Building Maintenance practices in future building projects and in making existing buildings green. Therefore, to endorse and drive the agenda of sustainable building maintenance in Nigeria, the barriers that hinder these practices must first be identified. This study aims to identify and assess the barriers to Sustainable Building Maintenance Practices in selected tertiary Institutions in Kaduna State with a view to making recommendations to enhance their adoption.

Table 1: Drivers and Barriers of Sustainable Building Practice

S/N	Drivers	Barriers
1	Financial incentives	Affordability
2	Building regulations	Lack of client demand
3	Client awareness	Lack of client awareness
4	Client demand	Lack of proven alternative technologies
5	Planning policy	Lack of business case understanding
6	Taxes/levies	Building regulations
7	Investment	Planning Policy
8	Labeling/measurement	Lack of labelling/measurement standard

Source: Hakkinen and Belloni (2011)

2.0 METHODOLOGY

This research study aimed to collate the opinions of the maintenance officers or operatives in selected tertiary institutions in Kaduna State on the barriers to sustainable building maintenance practice. In order to capture the data, a questionnaire survey was developed, it is because the selection of a survey to achieve results is seen as one of the most effective ways to gather feedback, as it is a well-used tool in social science research topics (Babbie, 2008). It was necessary, therefore to sample opinions of the professionals who are mainly responsible for carrying out maintenance practices, which informed the choice of reaching out to the different maintenance operatives working in the physical facilities units and maintenance departments of the three (3) selected tertiary institutions to reach meaningful conclusions.

2.1 SAMPLING TECHNIQUE AND SAMPLE SIZE

2.1.1 Sampling technique

Adopting the most adequate sampling technique is a key consideration in all Quantitative Research, which usually aims at generalising findings of a study to a larger population. It is important to have the sample size required, using the most appropriate sampling technique to obtain a representative sample (Teddlie and Yu, 2007). The basic idea behind sampling is to

obtain statistical information of either a qualitative or quantitative type for a whole by examining just a selected unit of the whole (Creswell, 2018).

This study uses both convenience and purposive sampling techniques. Teddlie and Yu (2007) stated that convenience sampling involves drawing samples that are both easily accessible and willing to participate in a study. Convenience sampling (also known as grab sampling or opportunity sampling) is a type of non-probability sampling that involves the sample being drawn from that part of the population that is close at hand.
The uncertainty in determining the definite number of maintenance operatives active within these institutions, and also those who will be willing to fill the data collection instruments, puts a case for the adoption of convenience sampling. Creswell (2018). The purposive sampling technique was also used for this study, as it is a non-probability sampling technique that is based on the unique features of a sample population and the objectives of the study. It is also referred to as a selective or judgmental sampling technique. It is when a researcher uses their sense of judgement in deciding who participates in the study, which in the case of this research, are specifically maintenance officers within these tertiary institutions, who have been deemed eligible to answer the questions because they have good knowledge of sustainability. However, the main subject of this study and the key arguments that builds up the study has to do with maintenance officers and facility managers competences and functions as a building professionals, therefore, if Questions are to be answered on maintenance practices, then the best respondent to this questions will be will be the maintenance officers directly responsible for these practices, because that is the best strategy to obtain valid and reliable data on the subject.
The typical case nature of Purposive sampling makes it possible to use information from research that has been conducted in the past, update it, in order to make it relevant in the present study (Kothari, 2007). This is also true with this study because information with regards to barriers to adopting sustainable maintenance practices carried out in the past was used to construct the questionnaire, which will make it updated when respondents provide the required information.
Purposive sampling depends on the availability of the targeted respondent to provide the relevant information needed, and it also considers averages, but the final selling point for the rationale behind this selection is the fact that when you adopt the purposive sampling technique, it allows for everyone in the population to be selected (Rai and Thapa, 2004). This is what informed the decision to adopt the total sample size method to determine the sample size for this research.

2.1.2 Sample size

A sample in a research study is defined as a small group being observed (Ary et. Al., 2009). Creswell (2018) also defined a sample as a subgroup extracted from a larger group being observed in order to come up with a generalisation that represents the larger population. According to Rai and Thapa (2004), if the number of a population is less than 100, the researcher should use the entire sample, and if it is more than 100 then the researcher is allowed to use about 10-15% or 20-25% or even 50% of the sample obtained. It is on this basis that this research used total sampling to obtain the data sample for this study. Kothari (2007) supports this argument by describing total sampling as a technique in collecting data by using the total number sample obtained. In line with this statement, the total number of respondents who filled the questionnaire is 53 which is less than 100; therefore 53 became the total sample size for this research.
Therefore, the population of this study included fifty-three (53) maintenance officers working in the physical facilities unit and maintenance departments of the selected tertiary institutions,

which are Ahmadu Bello University, Zaria, The Federal Polytechnic, Kaduna and Kaduna State College of Nursing, Kafanchan. Questionnaires were administered to these maintenance personnel working in these selected tertiary institutions in Kaduna state, out of which 53 were retrieved. By implication, a total of 53 questionnaires were analysed for this study, making a response rate of 100% with reference to the sampling technique adopted for this study. According to Moser and Kalton (1971), in Ogunsanmi (2015), 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 these is 100% which indicates an unbiased and higher value of the survey. To assess the barriers to the adoption of sustainable building maintenance practice in these selected Tertiary Institutions in the study area. The identified barriers were rated on a 5-point Likert scale as follows: 1 = strongly disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = strongly agree.

2.1.3 Method of analysis

According to Ary et. Al. (2009: 481) is the stage in research methodology where data collected is organised and interpreted. Data analysis is defined as the series of techniques adopted by a researcher to retrieve relevant information from the data obtained from respondents to enable a summarised description of the research subject to be made.

For this research, Descriptive statistics were adopted and used for the presentation of findings because the research was designed using a Quantitative approach, which encompassed mean score ranking on the data. The rankings were used to give remarks on the respondents' opinions or responses obtained, which is supported by Ary et. al (2009) Descriptive statistics is when the researcher formulates guidelines and procedures for the presentation of data in a comprehensive and meaningful way.

3.0 DATA PRESENTATION AND DISCUSSION OF RESULTS

The result revealed that the majority of the responses are maintenance officers who are trained facility managers and service engineers, with over 15 years of experience. This implies that the majority of the respondents have good working experience to adequately make an informed opinion on barriers to sustainable building maintenance practices.

Questionnaires were administered to each of the three selected institutions, out of which eight een (18) were retrieved from Ahmadu Bello University, Zaria, Nineteen (19) from Federal Po lytechnic Kaduna and sixteen (16) from Kaduna State College of Nursing, Kafanchan, makin g a total of 53 questionnaires retrieved. In all, a total of 53 questionnaires were analysed for t his study, making the response rate 100%, based on the total sample method adopted as suppo rted by (Rai and Thapa, 2004) and (Kothari, 2007).

3.1 Barriers to the Adoption of Sustainable Building Maintenance Practices Table 2: Mean ranking on the barriers to the adoption of sustainable building mai ntenance practices.

S / N	Barriers to Sustainable Maintenance Practices	Mean Score	Rank	Standard Deviation	Remarks
1	Lack of knowledge and awareness of sustainable building maintenance and its benefits.	4.11	1st	0.42	Agreed
2	Lack of incentives and govern	3.99	2nd	0.72	Agreed

	ment policies in promoting Su stainable building maintenanc e practice.				
3	Perceived higher cost compare d to a conventional building	3.98	3rd	0.69	Agreed
4	Inconsistency/uncoordinated r egulation	3.94	4th	0.77	Agreed
5	Perceived higher cost compare d to a conventional building	3.84	5th	0.76	Agreed
6	Lack of legislation, enforceme nt and monitoring	3.75	6th	0.89	Agreed
7	Lack of design and constructio n team and a strategy to prom ote sustainable building maint enance	3.69	7th	0.66	Agreed
8	Insufficient support and leader ship by various levels of gover nment.	3.66	8th	1.03	Agreed
9	Resistance to change	3.62	9th	0.73	Agreed
10	Labelling and measurement, b uilding code and regulation	3.41	10th	0.90	Uncertain
11	Lack of faith in the effectivene ss of sustainable maintenance	3.31	11th	0.92	Uncertain
12	Absence of authority responsi ble for implementing the adop tion of sustainable building m aintenance.	3.30	12th	1.26	Uncertain
13	Reliability of using renewable energy sources	3.29	13th	0.90	Uncertain
14	Lack of technology, product, a nd scarcity of Sustainable materials	3.28	14th	0.98	Uncertain

The study identified and examined barriers to the adoption of sustainable building main tenance practices in the selected tertiary institutions in Kaduna state. The result from th e analysis shows that all the respondents have agreed with the existence of barriers hind ering the adoption of this practice. Table 1 shows these identified barriers and the respo nse of respondents on their level of agreement with these barriers, the result on table 1 r anks the level of agreement of respondents with these identified barriers to sustainable building maintenance practices with remarks based on the mean score, where mean sco re of 3.5-5.0 is Agreed, 2.5-3.4 is Uncertain and 1.0-2.4 is Disagreed. From the respons e, Lack of knowledge and awareness of sustainable building maintenance and its benefi ts is ranked 1st with a mean score of 4.11, followed by Lack of incentives and governm ent policies in promoting Sustainable building maintenance practice. Which is ranked 2nd with a mean score of 3.99. The respondents are uncertain about labelling and measur ement, building code and regulation and Lack of faith in the effectiveness of sustainabl e building maintenance practices, which were ranked 10th and 11th with a mean score of 3.41 and 3.39, respectively. Therefore, it can be deduced from the remarks on the table above that the respondents in the selected tertiary institutions are in agreement with the identified barriers as obstacles to the adoption of sustainable building maintenance pra

ctice in their respective institutions. However, these responses were further tested to dis cover if there is a significant difference in the responses between the selected tertiary in stitutions.

3.2 ANOVA Test of significant difference in the barriers to the adoption of sustain able building maintenance practices between the selected tertiary institutions in K aduna State.

Table 3: ANOVA test of significant difference in the barriers to sustainable building ma intenance practices between the selected tertiary institutions in Kaduna state.

S/N	Barriers to Sustainable Building Maintenance Practice	Mean			P Value
		ABU Zaria	Kaduna Polytechnic	College of Nursing, Kaf.	
1.	Lack of knowledge and awareness of sustainable building maintenan ce and its benefits	3.83	3.68	3.43	0.541
2.	Lack of incentives and governmen t policies in promoting Sustainable building maintenance practice.	4.11	4.00	3.81	0.492
3.	Insufficient government incentive	4.06	4.11	3.75	0.280
4.	Inconsistency/uncoordinated regul ation	4.11	3.89	3.81	0.516
5.	Perceived higher cost compared to a conventional building	4.00	3.84	3.69	0.509
6.	Lack of legislation, enforcement a nd monitoring	3.61	3.74	3.94	0.581
7.	Lack of design and construction te am and a strategy to promote susta inable building maintenance	3.56	3.79	3.75	0.543
8.	Insufficient support and leadership by various levels of government.	3.94	3.78	3.19	0.082
9.	Resistance to change	3.39	3.79	3.69	0.241
10.	Labelling and measurement, build ing code and regulation	3.56	3.32	3.38	0.720
11.	Lack of faith in the effectiveness o f sustainable maintenance	3.72	3.58	2.81	0.007
12.	Absence of authority responsible f or implementing the adoption of s ustainable building maintenance.	3.17	3.21	3.56	0.620
13.	Reliability of using renewable ene rgy sources	3.17	3.11	3.63	0.194
14.	Lack of technology, product and s carcity of Sustainable material s	3.06	3.21	3.62	0.229

The one-way ANOVA test for the significant difference in the barriers to the adoption of sustainable building maintenance practices between the three selected tertiary institu tions in Kaduna State (ABU Zaria, Kaduna Polytechnic, and College of Nursing Kafan chan). From Table 2 above, it can be seen that the P value (0.541) on the Lack of knowl edge and awareness of sustainable building maintenance and its benefits. And the P val ue (0.492). Lack of incentives and government policies in promoting Sustainable buildi ng maintenance practice are above the 0.05 level of significance. This indicates that the re is no significant difference in these barriers between the three selected institutions. A nother important observation from table 2 above is that the P values for all the other bar riers to sustainable building maintenance practices are above the 0.05 level of significa nce except for insufficient support and leadership by various levels of government and lack of faith in effectiveness of sustainable maintenance which have P values of 0.082 a nd 0.007 respectively, below the 0.05 level of significance which indicates that there is a significant difference in these barriers. Therefore, it can be concluded from the one-w ay ANOVA test results in Table 2 that there is no significant difference in the barriers t o the adoption of sustainable building maintenance practices between the selected tertia ry institutions in Kaduna State.

4.0 CONCLUSION AND RECOMMENDATION

This study shows that all the identified barriers are important to promote sustainable building maintenance practice. The respondents have confirmed that all the listed barriers are stumbling blocks to the adoption of sustainable building maintenance practices in their respective institutions. But placed more emphasis on the lack of public awareness about the benefits and opportunities of sustainable building maintenance practices, and Lack of incentives and government policies in promoting Sustainable building maintenance practices. The study also reveals that there is no significant difference in the barriers to the adoption of sustainable building maintenance practice between the selected tertiary institutions in Kaduna State.

From the findings, educating all segments of society about the need for sustainable building maintenance practice and training building professionals in sustainable building concepts and methods are the most essential ways of encouraging the more widespread adoption of sustainable building maintenance practices. Such education could create a greater demand for sustainable building products and services, which would boost these markets. Clearly, most of the barriers mentioned so far are knowledge-related. This shows that there is a skills and knowledge gap amongst key players, which needs to be addressed with some urgency. Therefore, an improvement of skills and expertise among the professionals in the construction sector is required. However, there are also practical barriers related to the availability of sustainable materials, products and technologies that need to be addressed. Other barriers, such as policies and incentives and government regulations and incentives, reveal a lack of political will, explaining the lack of legislation to mandate energy efficiency or environmental preservation in building codes and standards.

Professional and regulatory bodies, as well as the educational sector should make efforts to eradicate the barriers as identified in this study, by organizing trainings and workshops for all the relevant professionals involved in the construction industry and the creation and 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 sustainable building practices for future project.

The educational sector and governments, being the largest single owners of buildings in a country, need to be very supportive of sustainable building maintenance practices by implementing sustainable building maintenance practices in their own institutional buildings to demonstrate leadership and environmental responsibility.

5.0 LIMITATION OF THE STUDY

The study focused on only three tertiary institutions in Kaduna State (ABU Zaria, Kaduna Polytechnic, and Kaduna State College of Nursing, Kafanchan). This narrow coverage limits the generalizability of the findings to other Nigerian states, private institutions, or noneducational public buildings.

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