

FACTORS INFLUENCING THE ADOPTION OF ECO-FRIENDLY MATERIALS IN SUSTAINABLE CONSTRUCTION IN LAGOS, NIGERIA

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ABSTRACT

The construction industry is a significant contributor to economic development but also a major source of environmental degradation due to high level of resource consumption and carbon emissions. Sustainable construction, which utilizes eco-friendly materials such as bamboo, recycled concrete, recycled steel and recycled plastic, is crucial for mitigating these impacts. However, its adoption in Nigeria faces significant challenges. This study therefore assessed the factors influencing the adoption of eco-friendly materials for sustainable construction in Lagos, Nigeria. With a quantitative research approach, a well-structured questionnaire was administered on 174 firms and a total of 66 copies of the questionnaire were returned by respondents from 8 consulting firms, 39 contracting firms, 5 consortium firms, and 14 government ministries, departments and agencies located in Lagos. Data collected were analyzed using percentage, mean score, analysis of variance and factor analysis. The findings revealed that the primary factors motivating adoption are waste reduction, reduced greenhouse gas emissions, and decreased pollution, while the main inhibiting factors are a lack of expertise and technical capacity, limited technical guidelines, and limited training and awareness. The study concludes that eco-friendly materials are being adopted for sustainable construction but the level of adoption in Lagos is being hindered by a significant number of technical and institutional barriers. It recommends the need to develop strategies for enhanced technical capacity building, clear policies guidelines, and stronger government incentive schemes to foster a more sustainable practices in construction sector.

Keywords: Adoption, Eco-Friendly, Influencing Factors, Materials, Sustainability

1.0 INTRODUCTION

The construction industry is essential to the economic advancement of numerous nations and Nigeria is not exempted. It is making a significant contribution to gross domestic product and employment generation. Nevertheless, this sector is responsible for a notable portion of environmental degradation due to its pronounced consumption of resources, considerable waste production, and elevated carbon emissions (Uchehara et al., 2022). 39% of the total carbon footprint comes from construction processes and production with materials such as concrete, steel, and traditional bricks contributing significantly to this footprint (Dighade et al., 2024). The global construction carbon footprint is projected to more than double by 2050, with cement, brick, and metal use responsible for over half of emissions (Li et al., 2025). With increasing global environmental challenges, sustainable construction has emerged as a central approach for reducing the adverse impacts associated with the construction industry (Akindele et al., 2023).

Sustainable methods make use of eco-friendly materials and advanced technologies, consume minimal water, boost energy efficiency, preserve resources, reduce waste, and promote safer and healthier living conditions (Njeri et al., 2023). Eco-friendly construction materials are defined as materials that reduce energy consumption and environmental impact (Srivastava et al., 2019). Eco-friendly construction materials include bamboo, recycled concrete, insulation, cob, recycled steel, sheep's wool, reclaimed wood, cork, straw bales, recycled plastic, ashcrete, ferrock, hempcrete, recycled rubber, earth block and geopolymer cement, which protect the environment while maintaining building stability and functionality (Barbulianno, 2024; Hassan et al., 2022).

Eco-friendly construction materials reduce carbon footprint, minimize waste, result in long-term cost saving, reduce energy consumption, regulate indoor temperatures, promote better indoor air quality, operational efficiency, minimize water consumption, and conserve natural resources (Magicrete, 2024). The utilization of fly ash in concrete mix designs in the climate of Nigeria has shown that there is an opportunity to cut the quantity of cement used by as much as 30% (Adewumi et al., 2023).

Although the awareness of the advantages of sustainable construction is increasing, its adoption in Nigeria remains low due to numerous obstacles that restrict broad implementation. These challenges encompass a range of factors, including regulatory, organizational, social, cultural, and technological dimensions (Unegbu et al., 2025). Like, there are paucity of studies globally including Nigeria that specifically evaluated eco-friendly materials and factors influencing their adoption for sustainable construction, hence, this study. This study focusses on factors influencing the adoption of eco-friendly materials for sustainable construction in Lagos, Nigeria. The specific objectives examine the factors motivating and factors inhibiting the adoption of eco-friendly materials for sustainable construction with a view to minimizing the consumption of fossil fuel and generation of carbon emissions emanating from the production of conventional construction materials.

2.0 LITERATURE REVIEW

2.1 Factors Influencing the Adoption of Eco-Friendly Materials for Sustainable Construction

The adoption of conventional and non-conventional materials like eco-friendly materials for construction is being influenced by certain factors. These factors could be motivating or inhibiting and this paper grouped factors influencing the adoption of eco-friendly materials for sustainable construction in that order. Motivating factors are factors that encourage the usage of eco-friendly materials for sustainable construction, which include the possibilities of recycling and reuse of materials, water conservation, energy efficiency, use of renewable materials, waste reduction, positive social practices, and reducing air and noise pollution (Chepngeno & Letema, 2025). Bode (2024) opined that factors motivating recycling and reuse of building materials include waste reduction, energy saving, resource conservation, cost savings, job creation, innovation and market growth, cultural preservation, improved building quality and community engagement.

Vetrotech, (2024) also argued that adopting sustainable building practices is crucial for sustainable development for several reasons which include reducing environmental impact, enhancing energy efficiency, promoting health and well-being, market demand and economic benefits. According to Accacia (2025), the key benefits of using eco-friendly construction materials include reduced environmental impact, better energy efficiency, health indoor environments, long term cost savings, helps earn green certifications and boost brand and market value. Fluidconstruction (2023) argued that the benefits of eco-friendly constructions include improved indoor

air quality, energy efficiency, saving costs, environmental impact, community health, job creation, innovation and technology, long term investment and resilience. Abera (2024) in research identified forest conservation, thermal and acoustic qualities, lower greenhouse gas emissions, reduced pollution and employment as the drivers of eco-friendly material adoptions. Based on these reviews, the list of factors motivating the adoption of eco-friendly materials for sustainable construction are presented in Table 3.

Likewise, there are some factors inhibiting the adoption of eco-friendly materials for sustainability. In a study conducted by Chepngeno and Letema (2025), such factors inhibiting the adoption of eco-friendly materials for sustainable construction include the level of knowledge and awareness, market demand, cost of implementation, access to funding and green financing, compliance and enforcement of policies and regulations, availability of construction technologies, cooperation and commitment by project stakeholders, application of sustainable rating systems, expertise and technical capacity, and government support. These factors affect how stakeholders engage with and prioritize sustainable methods and adoption throughout building projects.

Accacia (2025) also identified barriers identified by Accacia (2025) such as high costs, limited awareness, and weak policy enforcement often inhibiting the adoption of eco-friendly materials for sustainable construction. Similarly, higher upfront costs, limited availability, knowledge and training gaps, lack of standardization, regulatory hurdles and perceived performance risks were identified by Isang (2023) as factors inhibiting the adoption of eco-friendly materials for construction. Some of the issues to be addressed for the adoption of eco-friendly materials for sustainable construction as identified by Abera (2024) include material performance, cost effectiveness, regulatory compliance and public acceptance. Hassan et al. (2024) argued that the barriers to adoption of eco-friendly materials include lack of local production, absence of incentives, limited awareness, lack of technical guidelines, market resistance and policy gaps in regulations. Table 1 highlights the factors motivating the adoption of eco-friendly materials for sustainable construction while Table 2 highlights the factors inhibiting the adoption of eco-friendly materials for sustainable construction.

Table 1: Factors Motivating the Adoption of Eco-Friendly Materials for Sustainable Construction

| S/N | Motivating Factors | Sources |
|-----|--|---|
| 1 | Reduced greenhouse gas emissions | Abera, 2024 |
| 2 | Lower resource consumption | Bode, 2024 |
| 3 | Decreased pollution | Chepngeno & Letema, 2025 |
| 4 | Waste reduction | Chepngeno & Letema, 2025; Bode, 2024 |
| 5 | Long term investment | Fluidconstruction, 2023 |
| 6 | Biodegradability and recyclability | Chepngeno & Letema, 2025 |
| 7 | Enhanced building performance | Bode, 2024 |
| 8 | Improved thermal and acoustic properties | Abera, 2024 |
| 9 | Improved water efficiency | Chepngeno & Letema, 2025 |
| 10 | Reduce environmental impact | Bode, 2024; Vetrotech, 2024; Accacia, 2025; Fluidconstruction, 2023 |
| 11 | Technology | Fluidconstruction, 2023 |
| 12 | Resilience | Fluidconstruction, 2023 |
| 13 | Helped earn green certification | Accacia, 2025 |
| 14 | Innovation | Bode, 2024; Accacia, 2025; Fluidconstruction, 2023 |
| 15 | Reduced noise pollution | Chepngeno & Letema, 2025; Abera, 2024 |
| 16 | Market growth | Bode, 2024; Vetrotech, 2024; Accacia, 2025 |
| 17 | Reduced air pollution | Chepngeno & Letema, 2025; Abera, 2024 |
| 18 | Job creation | Bode, 2024; Abera, 2024; Fluidconstruction, 2023 |
| 19 | Long term cost savings | Bode, 2024; Accacia, 2025; Fluidconstruction, 2023 |
| 20 | Improved indoor air quality | Accacia, 2025; Fluidconstruction, 2023 |
| 21 | Improved energy efficiency | Chepngeno & Letema, 2025; Bode, 2024; Vetrotech, 2024; Accacia, 2025; Fluidconstruction, 2023 |
| 22 | Promote health and well-being | Vetrotech, 2024; Fluidconstruction, 2023 |
| 23 | Improved community engagement | Bode, 2024, |

Table 2: Factors Inhibiting the Adoption of Eco-Friendly Materials for Sustainable Construction

| S/N | Inhibiting Factors | Sources |
|-----|--|--|
| 1 | Expertise and technical capacity | Chepngeno & Letema, 2025 |
| 2 | High cost of production | Chepngeno & Letema, 2025; Accacia, 2025; Isang, 2023 |
| 3 | Material performance | Accacia, 2025; Abera, 2024 |
| 4 | Insufficient Technology | Chepngeno & Letema, 2025 |
| 5 | Limited awareness about eco-friendly materials | Chepngeno & Letema, 2025; Accacia, 2025; Hassan et al. 2024; Isang, 2023 |
| 6 | Public acceptance | Abera, 2024; Hassan et al. 2024 |
| 7 | Poor government support | Chepngeno & Letema, 2025; Hassan et al. 2024 |
| 8 | Limited availability | Isang, 2023 |
| 9 | Lack of local production | Hassan et al. 2024 |
| 10 | Lack of standardization | Isang, 2023 |
| 11 | Market demand | Chepngeno & Letema, 2025 |
| 12 | Regulatory compliance | Abera, 2024; Isang, 2023 |
| 13 | Access to funding | Chepngeno & Letema, 2025 |
| 14 | Weak policy enforcement | Accacia, 2025; Hassan et al. 2024 |
| 15 | Lack of technical guidelines | Hassan et al. 2024 |

3.0 METHODOLOGY

The aim of this paper is to assess factors influencing the adoption of eco-friendly materials for sustainable construction in Lagos, Nigeria with a view to reduce carbon footprint. The target population for this research comprises construction professionals, which include architects, quantity surveyors, builders, and engineers, in either consulting, contracting, consortium firms or government ministries, departments and agencies in the study area. The study employed quantitative research methods to achieve its aim and the data reported were gathered with the use of a well-structured questionnaire. The study population was categorized into four groups. The consulting firm comprises 121 architectural firms, 141 quantity surveying firms, 92 engineering firms and 70 building firms whose headquarters are located in Lagos, and this gives a sampling frame of 424 for consulting firms. This was derived from the list of registered firms in their professional institutions.

The sampling frame of the selected contracting firms includes 54 firms whose headquarters are in Lagos out of the 94 registered members of the Federation of Construction Industry (FOCI) while the sampling frame of the selected government ministries, departments and agencies (MDAs) is 85. However, since there is no direct source to the list of consortium firms in Lagos state, a pilot study was conducted to arrive at 15 consortium firms. This gave a total of 578 sampling frames. Out of the total sampling frame, a random sampling method was employed to determine the sample size for the study. A sample size of 30% of the sampling frame was randomly selected giving the study 173 sample size.

Data reported was gathered with the use of questionnaire. The research instrument was structured into sections. Background information about the respondents and firms was gathered in section A while sections B and C addressed the specific objectives of the study. The study employed physical method for the distribution of questionnaires to the respondents. However, a total of 66 responses were received at the end of the collection period out of 174 copies distributed. This gives a response rate of 38.2% of the sample size. Data received were analyzed using descriptive and inferential statistical techniques through Statistical Package for Social Sciences (SPSS) software. The descriptive statistics used were frequency distribution and mean score while the inferential statistics used were the analysis of variance (ANOVA) and factor analysis. Frequency distribution in percentage was used to present the demographic characteristics of respondents and the firms. While the mean score was used for questions on a 5-Likert-scale, which aims to assess central tendencies. Analysis of variance (ANOVA) was used to compare perceptions and test significant differences in responses among firms. Exploratory factor analysis (EFA) was employed to identify underlying factors motivating and inhibiting the adoption of eco-friendly materials for sustainable construction. The EFA also regroups these factors into a small group for ease of description.

4.0 RESULTS

This section presents the results obtained from the data analysis. These include results of the general profile of respondents. The section also presents results obtained in identifying the factors influencing the adoption of eco-friendly construction materials in the study area.

4.1 General Profile of the Respondents and companies

Table 3 presents the general profile of the respondents including the nature of organization, profession of respondents, professional membership, years of work experience among others. The result shows that 59.1% of the respondents are from contracting firms while 12.1%, 21.2% and 7.58% are from consulting firms, government ministries, and consortium firms respectively. This shows that majority (more than 80%) of the respondents are from contracting and government ministries, departments and agencies (MDAs).

The result on specializations shows that 42.4% specialized in building works. This is followed by civil work (27.3%), building work and civil work (19.7%) and industrial engineering (10.6%). Results on the year of establishment of the firms showed that 50% of firms have been in operation between in less than 5 years while 12.1%, 12.1% and 9.1% have 5 – 10 years, 11-15 years and 16-20 years respectively. However, 16.7% of the firms have been in operation for more than 20 years. The result on size of employees shows that 51.5% had less than 10 employees, while 24.2%, 15.2%, and 9.1% had 10-49, 50-249 and more than 250 employees respectively. The results also showed that 57.6% has an annual revenue of <50 million naira, 21.2% has >5 billion naira, 12.1% has 50 – 249 million naira, 6.1% has 250 – 999 million naira and 3% did not state their annual revenue. Result on the financial worth of assets of the firm shows that, 56.1% has a worth of <50 million, while 16.7%, 13.6%, 10.6% and 3% has a worth of 50 – 249 million, >5 billion, 250-999 million, and 1-5 billion respectively.

The result on respondents' professional designation showed that 33.3% of the respondents are architects, followed by both builders and quantity surveyors (22.7% each), and engineers (21.2%). However, results of their professional membership showed that 31.8% are fellow or member of the Nigerian Institute of Architects (NIA), while 22.7%, 22.7% and 21.2% are fellow or member of the Nigerian Institute of Builders (NIOB), Nigerian institute of quantity surveyors and Nigerian Society of Engineers (MNSE).

The result on the respondent professional registration shows that 31.8% are registered members of Architect Registration Council of Nigeria (ARCON), while 21.2%, 22.7% and 22.7% are registered members of Council of Registered Builders of Nigeria (CORBON), Council of the Registration of Engineering in Nigeria (COREN) and Quantity Surveyors Registration Board of Nigeria (QSRBN) respectively. Results on the highest academic qualification showed that 50.0% had B.Sc./B.Tech degrees, while 16.7%, 16.7%, 13.6%, and 3% had M.Sc./MBA, PhD, HND and ND degrees respectively. The result further showed that 51.5% of the respondents had less than 5 years of work experience, while 18.2%, 13.6%, 10.6%, and 6.1% had between 11–15 years, 5-10 years, >20 years and 16 -20 years of work experience respectively.

Table 3: General Profile of the Respondents and Firms

| General Profile | Frequency | Percent % |
|---|-----------|------------|
| Nature of respondent firms | | |
| Consulting | 8 | 12.1 |
| Contracting | 39 | 59.1 |
| Consortium | 5 | 7.58 |
| Government ministries, departments and agencies | 14 | 21.2 |
| Total | 66 | 100 |
| Business operations/specializations | | |
| Building works and Civil works | 13 | 19.7 |
| Building works | 28 | 42.4 |
| Civil works | 18 | 27.3 |
| Industrial engineering | 7 | 10.6 |
| Total | 66 | 100 |

| General Profile | Frequency | Percent % |
|---|------------------|------------------|
| Years of establishment | | |
| <5 years | 33 | 50 |
| 5-10 years | 8 | 12.1 |
| 11-15 years | 8 | 12.1 |
| 16-20 years | 6 | 9.1 |
| >20 years | 11 | 16.7 |
| Total | 66 | 100 |
| Size of employees | | |
| <10 | 34 | 51.5 |
| 10-49 | 16 | 24.2 |
| 50-249 | 10 | 15.2 |
| >250 | 6 | 9.1 |
| Total | 66 | 100 |
| Annual revenue (in naira) | | |
| >5 billion | 14 | 21.2 |
| <50 million | 38 | 57.6 |
| 50-249 million | 8 | 12.1 |
| 250-999 million | 6 | 9.1 |
| Total | 66 | 100 |
| Financial worth of assets (in naira) | | |
| <50 million | 37 | 56.1 |
| 50-249 million | 11 | 16.7 |
| 250-999 million | 7 | 10.6 |
| 1-5 billion | 2 | 3 |
| > 5 billion | 9 | 13.6 |
| Total | 66 | 100 |
| Professional Designation | | |
| Architects | 22 | 33.3 |
| Builders/ Project managers | 15 | 22.7 |
| Engineers | 14 | 21.2 |
| Quantity Surveyors | 15 | 22.7 |
| Total | 66 | 100 |
| Professional Membership | | |
| F/MNIA | 21 | 31.8 |
| F/MNIOB | 15 | 22.7 |
| F/MNIQS | 15 | 22.7 |
| F/MNSE | 14 | 21.2 |
| None | 1 | 1.5 |
| Total | 66 | 100 |

Table 3: General Profile of the Respondents cont'd

| General Profile | Frequency | Percent % |
|---------------------------------------|------------------|------------------|
| Professional Registration | | |
| ARCON | 21 | 31.8 |
| CORBON | 14 | 21.2 |
| COREN | 15 | 22.7 |
| None | 1 | 1.5 |
| QSRBN | 15 | 22.7 |
| Total | 66 | 100 |
| Highest Academic Qualification | | |
| B.Sc/B.Tech | 33 | 50 |
| HND | 9 | 13.6 |
| M.Sc /MTech | 11 | 16.7 |
| ND | 2 | 3 |
| Ph.D | 11 | 16.7 |
| Total | 66 | 100 |
| Years of work experience | | |
| <5 | 34 | 51.5 |
| 5-10 | 9 | 13.6 |
| 11-15 | 12 | 18.2 |
| 16-20 | 4 | 6.1 |
| >20years | 7 | 10.6 |
| Total | 66 | 100 |

4.2 Factors Motivating the Adoption of Eco-Friendly Materials for Sustainable Construction

The analysis of the factors motivating the adoption of eco-friendly materials across different sectors within the construction industry was presented in Table 4. Respondents from various sectors, including consortiums, consulting firms, contracting companies, and government ministries, provided their perspectives on the drivers of their adoption. From the overall results, waste reduction was ranked the highest with a mean score (MS) of 4.00. This is followed by reduced greenhouse gas emissions (MS = 3.90) and decreased pollution (MS = 3.85). On the other hand, resilience (MS = 3.23) and improved water efficiency (MS = 3.20) were ranked lower.

In consulting firms, the top ranked motivating factor includes promoting health and well-being (MS = 3.86) and lower resource consumption (MS = 3.71). On the other hand, factors with the least motivating influence are improved water efficiency (MS = 2.71) and market growth (MS = 2.57). From the view of construction firms, the top-ranking factor motivating the adoption of eco-friendly material is waste reduction (MS = 4.05). Other factors with high motivating influence are reduced greenhouse gas emission (MS = 3.86), decreased pollution (MS = 3.82) and reduce environmental impact (MS = 3.64). The least ranked motivating factors are job creation and resilience with each having a mean score of 3.18.

From the view of consortium firms, the top-ranking factor motivating the adoption of eco-friendly material is reduced greenhouse gas emissions (MS = 5.00). This is strictly followed by long term investment (MS = 4.67), decreased pollution (MS = 4.33) and technology (MS = 4.33). While the least ranked motivating factors include job creation, improved indoor air quality and resilience with each having a mean score of 2.67.

Table 4: Factors Motivating the Adoption of Eco-Friendly Materials for Sustainable Construction

| Motivating Factors | Overall | | Consulting | | Contracting | | Consortium | | Government MDAs | | ANOVA | |
|--|---------|----|------------|----|-------------|----|------------|----|-----------------|----|-------|------|
| | MS | R | MS | R | MS | R | MS | R | MS | R | F | Sig. |
| Reduced greenhouse gas emissions | 3.90 | 2 | 3.43 | 9 | 3.86 | 2 | 5.00 | 1 | 4.00 | 11 | 1.315 | .284 |
| Lower resource consumption | 3.73 | 5 | 3.71 | 2 | 3.55 | 8 | 4.00 | 5 | 4.13 | 6 | .788 | .509 |
| Decreased pollution | 3.85 | 3 | 3.57 | 3 | 3.82 | 3 | 4.33 | 3 | 4.00 | 11 | .380 | .768 |
| Waste reduction | 4.00 | 1 | 3.57 | 3 | 4.05 | 1 | 4.00 | 5 | 4.25 | 4 | .576 | .635 |
| Long term investment | 3.75 | 4 | 3.43 | 9 | 3.59 | 5 | 4.67 | 2 | 4.13 | 6 | 1.933 | .142 |
| Biodegradability and recyclability | 3.70 | 6 | 3.57 | 3 | 3.50 | 11 | 3.67 | 10 | 4.38 | 3 | 1.873 | .152 |
| Enhanced building performance | 3.70 | 6 | 3.29 | 12 | 3.59 | 5 | 3.33 | 13 | 4.50 | 2 | 2.367 | .087 |
| Improved thermal and acoustic properties | 3.53 | 12 | 3.14 | 15 | 3.41 | 13 | 3.33 | 13 | 4.25 | 4 | 2.228 | .102 |
| Improved water efficiency | 3.20 | 22 | 2.71 | 22 | 3.23 | 21 | 3.67 | 10 | 3.38 | 23 | .967 | .419 |
| Reduce environmental impact | 3.68 | 8 | 3.57 | 3 | 3.64 | 4 | 4.00 | 5 | 3.75 | 16 | .164 | .920 |
| Technology | 3.50 | 14 | 3.29 | 12 | 3.36 | 17 | 4.33 | 3 | 3.75 | 16 | 1.490 | .234 |
| Resilience | 3.23 | 21 | 3.00 | 18 | 3.18 | 22 | 2.67 | 21 | 3.75 | 16 | 1.269 | .300 |
| Helped earn green certification | 3.63 | 10 | 3.57 | 3 | 3.27 | 18 | 3.67 | 10 | 4.63 | 1 | 3.957 | .015 |
| Innovation | 3.63 | 10 | 3.29 | 12 | 3.59 | 5 | 3.33 | 13 | 4.13 | 6 | 1.525 | .225 |
| Reduced noise pollution | 3.48 | 17 | 2.86 | 21 | 3.41 | 13 | 4.00 | 5 | 4.00 | 11 | 2.306 | .093 |
| Market growth | 3.20 | 22 | 2.57 | 23 | 3.27 | 18 | 3.00 | 19 | 3.63 | 20 | 1.214 | .319 |
| Reduced air pollution | 3.28 | 20 | 3.00 | 18 | 3.27 | 18 | 3.33 | 13 | 3.50 | 22 | .365 | .778 |
| Job creation | 3.30 | 19 | 3.14 | 15 | 3.18 | 22 | 2.67 | 21 | 4.00 | 11 | 2.335 | .090 |
| Long term cost savings | 3.50 | 14 | 3.14 | 15 | 3.41 | 13 | 3.33 | 13 | 4.13 | 6 | 2.167 | .109 |
| Improved indoor air quality | 3.50 | 14 | 3.57 | 3 | 3.41 | 13 | 2.67 | 21 | 4.00 | 11 | 1.446 | .246 |
| Improved energy efficiency | 3.53 | 12 | 3.43 | 9 | 3.55 | 8 | 3.33 | 13 | 3.63 | 20 | .076 | .972 |
| Promote health and well-being | 3.68 | 8 | 3.86 | 1 | 3.55 | 8 | 4.00 | 5 | 3.75 | 16 | .342 | .795 |
| Improved community engagement | 3.48 | 17 | 3.00 | 18 | 3.45 | 12 | 3.00 | 19 | 4.13 | 6 | 2.095 | .118 |

In government ministries departments and agencies, the top ranked factors are helped earn green certificate (MS = 4.63), enhanced building performance (MS = 4.50) and biodegradability and recyclability (MS = 4.38). On the other hand, the least motivating factors are reduced air pollution (MS = 3.50) and improved water efficiency (MS = 3.38).

To test whether the opinions of the different stakeholder groups agree or disagree on how the identified factors motivate the adoption of eco-friendly materials, a one-way Analysis of Variance (ANOVA) was carried out. The test results reveal a significant difference in how the stakeholders perceived helped earn green certification (Sig. = 0.015, $p < 0.05$) as a motivating factor. This shows that their opinions differ significantly on how the prospect of earning green certification influences the adoption of eco-friendly materials. The result also reveals that the opinions of the stakeholders agree on all other factors motivating the adoption of eco-friendly materials for sustainable construction in the study area, as no other significant differences were found.

To assess the suitability of the collected data on factors motivating the adoption of eco-friendly materials for factor analysis, Table 5 presents the results of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. The KMO statistic quantifies the proportion of variance among variables that might be common variance, with a value exceeding 0.5 considered the minimum requirement for factor analysis to proceed. Furthermore, Bartlett's test of sphericity must be statistically significant ($P \leq 0.05$) to reject the null hypothesis that the correlation matrix is an identity matrix, indicating that the variables are related and thus suitable for structure detection. The results obtained from the analysis show a KMO value of 0.841, which greatly exceeds the minimum threshold and falls within the 'meritorious' range according to conventional interpretations. Furthermore, Bartlett's test of sphericity was statistically significant (Approx. Chi-Square = 952.212, $df = 253$, Sig. = .000). This confirms that the correlation matrix is not an identity matrix and has adequate correlations to proceed. Collectively, these results demonstrate that the collected data on the factors motivating the adoption of eco-friendly materials are valid and highly suitable for factor analysis.

Table 5: KMO and Bartlett's Test of Factors Motivating the Adoption of Eco-Friendly Materials for Sustainable Construction

| KMO and Bartlett's Test | | |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .841 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 952.212 |
| | Df | 253 |
| | Sig. | .000 |

4.3.1 Factor analysis of the factors motivating the adoption of eco-friendly materials

The result in Table 6 shows the principal factor extraction and varimax rotation of the factors motivating the adoption of eco-friendly materials for sustainable construction. The eigenvalues for the five extracted factors ranged from 2.239 to 4.329, and the percentage of variance explained by the 1st factor is 18.824%, the 2nd factor is 18.718%, the 3rd factor is 12.781%, the 4th factor is 10.270%, and the 5th factor is 9.734%. The cumulative percentage of variance explained by the extracted five factors accounted for 70.326%. Extraction method: Principal Component Analysis. The identified motivating factors are grouped into five principal factors as follows:

Factor 1: Health, Economic, and Environmental Co-benefits

Factor 2: Long-term Value and Environmental Stewardship

Factor 3: Regulatory and Impact Reduction Drivers

Factor 4: Market and Structural Resilience

Factor 5: Operational and Ambient Efficiency

Table 6: Principal factor extraction and varimax rotation of the Factors Motivating the Adoption of Eco-Friendly Materials for Sustainable Construction

| Motivating factors | Factor loading | Total | % of Variance | Cumulative % |
|--|----------------|-------|---------------|--------------|
| Factor 1: Health, Economic, and Environmental Co-benefits | | 4.329 | 18.824 | 18.824 |
| Improved indoor air quality | 0.849 | | | |
| Job creation | 0.767 | | | |
| Improved energy efficiency | 0.758 | | | |
| Long term cost savings | 0.664 | | | |
| Promote health and well-being | 0.655 | | | |
| Reduced air pollution | 0.633 | | | |
| Improved community engagement | 0.563 | | | |
| Factor 2: Long-term Value and Environmental Stewardship | | 4.305 | 18.718 | 37.542 |
| Long term investment | 0.793 | | | |
| Decreased pollution | 0.764 | | | |
| Biodegradability and recyclability | 0.751 | | | |
| Waste reduction | 0.715 | | | |
| Enhanced building performance | 0.65 | | | |
| Improved thermal and acoustic properties | 0.601 | | | |
| Factor 3: Regulatory and Impact Reduction Drivers | | 2.940 | 12.781 | 50.322 |
| Reduce environmental impact | 0.737 | | | |
| Helped earn green certification | 0.688 | | | |
| Lower resource consumption | 0.662 | | | |
| Technology | 0.586 | | | |
| Reduced greenhouse gas emissions | 0.524 | | | |
| Factor 4: Market and Structural Resilience | | 2.362 | 10.270 | 60.592 |
| Resilience | 0.811 | | | |
| Market growth | 0.646 | | | |
| Innovation | 0.548 | | | |
| Factor 5: Operational and Ambient Efficiency | | 2.239 | 9.734 | 70.326 |
| Improved water efficiency | 0.717 | | | |
| Reduced noise pollution | 0.668 | | | |
| Extraction Method: Principal Component Analysis. | | | | |
| Rotation Method: Varimax with Kaiser Normalization. | | | | |

Factor 1: Health, Economic, and Environmental Co-benefits. This factor accounts for 18.824% of the total variance of the motivating factors, with loading variables having a score that ranged from 0.563 to 0.849. The six components include improved indoor air quality (0.849), job creation (0.767), improved energy efficiency (0.758), long-term cost savings (0.664), promotion of health and well-being (0.655), and reduced air pollution (0.633). This factor represents a holistic motivation where direct human health benefits, such as better air quality, are intertwined with positive economic outcomes like job creation and cost savings, as well as broader environmental advantages.

Factor 2: Long-term Value and Environmental Stewardship. This factor accounts for 18.718% of the total variance, with loading variables having a score that ranged from 0.601 to 0.793. The five components include long-term investment (0.793), decreased pollution (0.764), biodegradability and recyclability (0.751), waste reduction (0.715), and enhanced building performance (0.650). This factor underscores motivation driven by a forward-looking perspective, emphasizing the enduring value of investments, the reduction of a project's lifecycle environmental footprint through waste management and circular economy principles, and the pursuit of superior performance.

Factor 3: Regulatory and Impact Reduction Drivers. This factor accounts for 12.781% of the total variance, with loading variables having a score that ranged from 0.524 to 0.737. The five components include reduced environmental impact (0.737), help in earning green certification (0.688), lower resource consumption (0.662), technology (0.586), and reduced greenhouse gas emissions (0.524). This factor highlights motivations linked to compliance and market recognition, such as achieving sustainability certifications, alongside a core objective of minimizing ecological damage and leveraging technology for greater resource efficiency.

Factor 4: Market and Structural Resilience. This factor accounts for 10.270% of the total variance, with loading variables having a score that ranged from 0.548 to 0.811. The three components are resilience (0.811), market growth (0.646), and innovation (0.548). This factor encapsulates the strategic motivations for adopting eco-friendly materials, focusing on enhancing the building's ability to withstand disruptions, capitalizing on expanding market opportunities, and fostering a reputation for innovation.

Factor 5: Operational and Ambient Efficiency. This factor accounts for 9.734% of the total variance, with loading variables having a score of 0.717 and 0.668. The two components are improved water efficiency (0.717) and reduced noise pollution (0.668). This factor represents motivations centered on optimizing resource use and improving the immediate environmental conditions for occupants, specifically targeting water conservation and acoustic comfort.

4.4 Factors Inhibiting the Adoption of Eco-Friendly Materials for Sustainable Construction

This section examines the extent to which certain factors inhibit the adoption of eco-friendly materials for sustainable construction, as perceived by the key stakeholders surveyed. The examination of these inhibiting factors was conducted cross-sectionally across four stakeholder groups: consulting firms, contracting firms, consortiums, government ministries, departments and agencies and the result is presented in table 7. From an overall perspective, the top-ranking factor that inhibits the adoption of eco-friendly materials is lack of expertise and technical capacity (MS=3.50). This is closely followed by public acceptance and a lack of technical guidelines, which are tied for the second rank (MS=3.48). On the other hand, material performance (MS=2.80), insufficient technology (MS=2.98), and market demand (MS=3.13) received the lowest ranks.

From the perspective of consulting firms, the highest ranked factor inhibiting the adoption of eco-friendly materials is limited training and awareness (MS=3.57). This is closely followed by expertise and technical capacity, public acceptance, limited availability, lack of standardization, and access to funding with each having a mean score of 3.29. On the other hand, material performance (MS=2.14) and insufficient technology (MS=2.29) were ranked the least inhibiting factors. Contracting firms most ranked inhibiting factor is lack of technical guidelines (MS=3.68), followed by weak policy enforcement (MS=3.59), high cost of production (MS = 3.45) and expertise and technical capacity (MS=3.41). Conversely, material performance (MS=3.09) and insufficient technology (MS=2.95) are the least ranked inhibiting factors.

For consortiums, the highest ranked inhibiting factor is access to funding (MS=4.00). This is strictly followed by expertise and technical capacity, limited training and awareness, limited availability, and poor government support which each have a mean score of 3.67. On the other hand, they ranked public acceptance (MS=2.33) and material performance (MS = 2.00) as their least important inhibiting factors. Government ministries, departments and agencies ranked public acceptance (MS=4.25) as the most significant inhibiting factor to adoption of eco-friendly materials. The second-ranked factor is poor government support (MS=4.00) followed by expertise and technical capacity (MS=3.88) and limited training and awareness (MS=3.75). On the other hand, they ranked high cost of production (MS=3.25), weak policy enforcement (MS=3.25) and material performance (MS = 2.88) as the least inhibiting factors influencing the adoption of eco-friendly materials.

To test statistical consensus among these diverse stakeholder perspectives, a one-way Analysis of Variance (ANOVA) was conducted. The test results reveal a significant difference only in the perception of public acceptance (F=2.946, Sig. = 0.046, p<0.05) as an inhibiting factor. This confirms the evident divergence, where government MDAs rank it highest and consortiums lowest. For all other factors, the opinions of the four stakeholder groups do not differ significantly, demonstrating a broad, cross-sectional agreement on the challenging landscape of technical, financial, and awareness-related barriers inhibiting the adoption of eco-friendly materials in the study area.

Table 7: Factors Inhibiting the Adoption of Eco-Friendly Materials for Sustainable Construction

| Inhibiting factors | Overall | | Consulting | | Contracting | | Consortium | | Government MDAs | | ANOVA | |
|----------------------------------|---------|----|------------|----|-------------|----|------------|----|-----------------|----|-------|------|
| | MS | R | MS | R | MS | R | MS | R | MS | R | F | Sig. |
| Expertise and technical capacity | 3.50 | 1 | 3.29 | 2 | 3.41 | 4 | 3.67 | 2 | 3.88 | 3 | .781 | .512 |
| High cost of production | 3.28 | 10 | 2.86 | 7 | 3.45 | 3 | 3.00 | 10 | 3.25 | 13 | .543 | .656 |
| Material performance | 2.80 | 15 | 2.14 | 15 | 3.09 | 13 | 2.00 | 15 | 2.88 | 15 | 1.729 | .178 |
| Insufficient Technology | 2.98 | 14 | 2.29 | 14 | 2.95 | 15 | 3.00 | 10 | 3.63 | 5 | 1.907 | .146 |
| Limited training and awareness | 3.43 | 4 | 3.57 | 1 | 3.23 | 10 | 3.67 | 2 | 3.75 | 4 | .584 | .630 |
| Public acceptance | 3.48 | 2 | 3.29 | 2 | 3.41 | 4 | 2.33 | 14 | 4.25 | 1 | 2.946 | .046 |
| Poor government support | 3.40 | 6 | 2.86 | 7 | 3.32 | 8 | 3.67 | 2 | 4.00 | 2 | 1.318 | .284 |
| Limited availability | 3.43 | 4 | 3.29 | 2 | 3.41 | 4 | 3.67 | 2 | 3.50 | 8 | .110 | .954 |
| Lack of local production | 3.28 | 10 | 2.71 | 10 | 3.32 | 8 | 3.33 | 6 | 3.63 | 5 | 1.262 | .302 |
| Lack of standardization | 3.30 | 8 | 3.29 | 2 | 3.23 | 10 | 3.00 | 10 | 3.63 | 5 | .359 | .783 |
| Market demand | 3.13 | 13 | 2.71 | 10 | 3.09 | 13 | 3.33 | 6 | 3.50 | 8 | .823 | .490 |
| Regulatory compliance | 3.23 | 12 | 2.43 | 13 | 3.41 | 4 | 3.33 | 6 | 3.38 | 11 | 1.930 | .142 |
| Access to funding | 3.33 | 7 | 3.29 | 2 | 3.23 | 10 | 4.00 | 1 | 3.38 | 11 | .549 | .652 |
| Weak policy enforcement | 3.30 | 8 | 2.57 | 12 | 3.59 | 2 | 3.00 | 10 | 3.25 | 13 | 1.737 | .177 |
| Lack of technical guidelines | 3.48 | 2 | 2.86 | 7 | 3.68 | 1 | 3.33 | 6 | 3.50 | 8 | 1.457 | .243 |

To evaluate the suitability of the data on factors inhibiting the adoption of eco-friendly materials for factor analysis, Table 8 presents the results obtained from the Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity. The value of KMO varies from 0 to 1, and a minimum value of 0.5 is advised for factor analysis to proceed. Also, the Bartlett's test of sphericity must be significant at $P \leq 0.05$. The results obtained from the analysis show a KMO value of 0.835, which greatly exceeds the minimum threshold and is classified as meritorious. Furthermore, Bartlett's test of sphericity was statistically significant (Approx. Chi-Square = 501.739, $df = 105$, Sig. = .000). This shows that the correlation matrix is factorable and that the collected data on the factors inhibiting the adoption of eco-friendly materials are valid and highly suitable for factor analysis.

Table 8: KMO and Bartlett's Test of Factors Inhibiting the Adoption of Eco-Friendly Materials for Sustainable Construction

| KMO and Bartlett's Test | | |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .835 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 501.739 |
| | Df | 105 |
| | Sig. | .000 |

4.4.1 Factor analysis of the factors inhibiting the adoption of eco-friendly materials

The result in Table 9 shows the principal factor extraction and varimax rotation of the factors inhibiting the adoption of eco-friendly materials for sustainable construction. The eigenvalues for the three extracted factors ranged from 2.512 to 3.629, and the percentage of variance explained by the 1st factor is 24.196%, the 2nd factor is 20.167%, and the 3rd factor is 16.749%. The cumulative percentage of variance explained by the extracted three factors accounted for 61.112%. Extraction method: Principal Component Analysis. The identified inhibiting factors are grouped into three principal factors as follows:

Factor 1: Structural and Market Barriers

Factor 2: Institutional and Governance Barriers

Factor 3: Technical and Economic Barriers

Factor 1: Structural and Market Barriers. This factor accounts for 24.196% of the total variance of the factors inhibiting adoption, with loading variables having a score that ranged from 0.360 to 0.813. The seven components include poor government support (0.813), limited availability (0.723), access to funding (0.722), limited awareness about eco-friendly materials (0.653), lack of standardization (0.596), regulatory compliance (0.566), and market demand (0.360). This factor represents a broad cluster of challenges related to the fundamental market infrastructure and support systems necessary for eco-friendly materials to thrive, highlighting a critical lack of foundational enablement from both government and the market.

Factor 2: Institutional and Governance Barriers. This factor accounts for 20.167% of the total variance, with loading variables having a score that ranged from 0.496 to 0.868. The four components include weak policy enforcement (0.868), lack of local production (0.705), lack of technical guidelines (0.673), and public acceptance (0.496). This factor underscores deficiencies in the regulatory and institutional framework, where even when policies exist, their weak enforcement, coupled with a lack of supporting technical documentation and local manufacturing capacity, creates a significant impediment to widespread adoption.

Factor 3: Technical and Economic Barriers. This factor accounts for 16.749% of the total variance, with loading variables having a score that ranged from 0.666 to 0.966. The four components include exposure and technical capacity (0.966), material performance (0.786), insufficient technology (0.716), and high cost of production (0.666). This factor highlights the direct practical and financial concerns of stakeholders, focusing on a perceived or actual lack of technical expertise, uncertainties about the performance and durability of eco-friendly materials, and the economic disincentives driven by high production costs.

Table 9: Principal factor extraction and varimax rotation of the Factors Inhibiting the Adoption of Eco-Friendly Materials for Sustainable Construction

| Inhibiting factors | Factor loading | Total | % of Variance | Cumulative % |
|---|----------------|-------|---------------|--------------|
| Factor 1: Structural and Market Barriers | | 3.629 | 24.196 | 24.196 |
| Poor government support | .813 | | | |
| Limited availability | .723 | | | |
| Access to funding | .722 | | | |
| Limited awareness about eco-friendly materials | .653 | | | |
| Lack of standardization | .596 | | | |
| Market demand | .580 | | | |
| Regulatory compliance | .566 | | | |
| Factor 2: Institutional and Governance Barriers | | 3.025 | 20.167 | 44.363 |
| Weak policy enforcement | .868 | | | |
| Lack of local production | .705 | | | |
| Lack of technical guidelines | .673 | | | |
| Public acceptance | .496 | | | |
| Factor 3: Technical and Economic Barriers | | 2.512 | 16.749 | 61.112 |
| Material performance | .786 | | | |
| Insufficient Technology | .716 | | | |
| High cost of production | .666 | | | |
| Expertise and technical capacity | .606 | | | |
| Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. | | | | |

5.0 DISCUSSIONS

The delivery of sustainable construction projects in Lagos, Nigeria is motivated by a range of factors, with waste reduction, reduced greenhouse gas emissions, and decreased pollution being the primary drivers. These findings are consistent with the research conducted by Bode (2024) and Chepngeno & Letema (2025), who identified environmental stewardship and resource efficiency as central motivations for adopting sustainable practices. Furthermore, the strong motivating influence of factors like improved indoor air quality and long-term cost savings aligns with the work of Fluidconstruction (2023) and Accacia (2025), who argued that the health and economic co-benefits of green buildings are significant incentives for stakeholders. The factor analysis further consolidated these drivers into five principal components, with Health, Economic, and Environmental Co-benefits emerging as the most significant cluster factors motivating the adoption of eco-friendly materials for sustainable construction in Lagos, Nigeria. This synthesis provides a more structured understanding that the motivation for adoption in Lagos, Nigeria is not monolithic but a confluence of health, economic, regulatory, and performance-related incentives.

However, the adoption of eco-friendly materials for sustainable construction in Lagos, Nigeria is hindered by several critical barriers. The most significant inhibiting factors identified in this study are a lack of expertise and technical capacity, a lack of technical guidelines, and limited training and awareness. These findings are consistent with the research conducted by Chepngeno & Letema (2025) and Hassan et al. (2024), who identified knowledge gaps and technical skill shortages as fundamental obstacles to sustainable construction. Similarly, the high ranking of limited availability and high production costs corroborates the work of Isang (2023) and Accacia (2025), who pointed to market immaturity and economic disincentives as major impediments. A notable divergence was observed in the perception of public acceptance, where government ministries viewed it as a top barrier while consortiums considered it the least. This suggests that the perceived market demand and social readiness for green construction vary significantly depending on the stakeholder's position in the industry. The factor analysis grouped these barriers to the adoption of eco-friendly materials for sustainable construction in Lagos, Nigeria into three principal components: Structural and Market Barriers, Institutional and Governance Barriers, and Technical and Economic Barriers. This categorization echoes the multi-faceted framework proposed by Chepngeno & Letema (2025), confirming that the challenges are not isolated but are deeply interconnected issues spanning the market, regulatory, and technical domains.

6.0 CONCLUSION

This study assessed the factors influencing the adoption of eco-friendly materials for sustainable construction in Lagos, Nigeria. The specific objectives analyzed the motivating and inhibiting factors influencing their adoption within the construction industry. A quantitative research approach was employed, utilizing a questionnaire survey to collect data from construction professionals, which was subsequently analyzed using descriptive and inferential statistical techniques. The paper concludes that the primary drivers for adoption of eco-friendly materials for sustainable construction are environmental and economic co-benefits, such as waste reduction and long-term savings. Conversely, major factors inhibiting the adoption of eco-friendly materials for sustainable construction are a lack of technical expertise, guidelines, and training, which can be categorized as Structural/Market, Institutional/Governance, and Technical/Economic barriers.

These findings highlight the need for a multi-pronged strategy. The government must enhance policy enforcement and provide incentives, while industry and educational institutions should focus on building technical capacity. Future research should develop localized technical guidelines for underutilized materials, investigate effective policy and fiscal incentives for local production, and design targeted interventions to overcome the identified barrier categories. Studies on strategies to boost public acceptance and market demand are also recommended.

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