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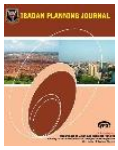

Motivating Factors for the Delivery of Sustainable Housing Projects in Nigeria

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Abstract

Sustainable housing projects are expected to alleviate the poor performance in energy consumption, and carbon emission of built environments and also a reduction in the cost-in-use of a building. Some factors promote the delivery of sustainable housing projects and these factors are described as motivators. This study therefore assessed motivating factors influencing the performance of sustainable housing projects. These were to enhance sustainable housing delivery. Primary data were collected using a structured questionnaire survey to elicit information on factors influencing the delivery of sustainable housing projects. A total enumeration of all the 259 stakeholders involved in the identified 167 units of sustainable housing projects was included in the survey. The respondents comprised Contractors, Developers, and Government. The data collected were analysed using mean ranking analysis (MRA) and factor analysis. The top 5 motivating factors of sustainable housing projects were; monitoring compliance with regulations (MS= 3.99); availability of stable macroeconomic (MS = 3.87); sustainable environment (MS = 3.87), appropriate sustainable design (MS = 3.86), efficient data management system and clear project criteria and standards (MS = 3.86). The study concluded that the 33 identified motivating factors could be parsimoniously reduced to 4 components of project-related factors, government-related factors, management-related factors, and individual stakeholder-related factors.

Keywords
Delivery, Factor analysis, Housing, Mean ranking, Stakeholders, Sustainability

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1. Introduction

The human search for an excellent quality lifestyle, sideways with the rise in the global populace, quick development, and the decrease of determinate, non-renewable possessions has shaped attendant ecological, social, and financial trials (Kibert, 2013). To recognize the place of sustainability as a dynamic idea of the late twentieth century and early twenty-first, it is important to determine the causes of this pattern shift (Bui *et al*, 2022). The quantity of consumption of the earth's source has since been confirmed to be a challenge as the use of materials such as timber, fossil fuels, and mineral ores happens more than they are replaced (Kibert, 2013). Given the general expectation of developing countries, it was recommended that the three Earth's worth of resources would be involved to afford the joint needs if these countries were to hold a comparable usage outline of developed countries (Pearce *et al*., 2012). Sustainable buildings are the outcome of sustainable environment strategies in the built environment which is broadly answerable for usage of natural resources and environmental waste. Sustainable buildings are automated buildings with their controller and automation systems. For this kind of building design, all stakeholders work together unanimously. The identification of likely pressures and opportunities by adopting these technologies, the choice of suitable technological capabilities for the company, the accomplishment of these technologies from different businesses, and the practice of them are crucial for the tactical management of technology. In a study by Robichaud & Anantatmula (2011), sustainability in construction procurement simply relates to the effective use of resources, energy, and recyclable materials, less pollution, as well as the application of life cycle costing with adequate focus on quality. These activities relate to the different stages of building procurement.

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From a totally ‘green’ emphasis, interest is now moving to a method that appears to perform in line with the triple bottom line (Gan et al 2015; Xiong *et al*., 2016), supported by the wider concepts of corporate sustainability.

The term *Sustainability* came to worldwide recognition in 1987 when the United Nations World Commission on Environment and Development (Brundtland Commission) provided its report on *Our Common Future* and progressive opinions for human development that is sustainable. Sustainable Development (SD) is deemed ‘a logical extension of arguments within the environmental literature of the 1960s, 1970s and early 1980s’ (Robinson, 2014) which balances environmental and socio-political worries. Sustainable housing is defined as the creation of structures and using environmentally responsible processes and resource-efficient throughout a building's life cycle from design to construction, operation, maintenance, renovation, and deconstruction (PMI, 2017). To tackle the adverse effects of housing activities on the environment, sustainable housing has emerged as the guiding and encouraged paradigm of development in the building sector (Dobson *et al*, 2013). Sustainable housing projects are expected to alleviate the poor performance in energy consumption, and carbon emission of built environments, and also a reduction in the cost-in-use of a building. Sustainable housing is the practice of creating constructed facilities by using best-practice, clean, and resource-efficient measures from the extraction of raw materials to demolition and disposal of its components (Hwang & Tan, 2012; Ojo, Mbowa, & Akinlabi, 2014). Research indicates that in Europe, the implementation of sustainable housing projects can reduce energy use by 42%, the total GHG by 35%, materials extraction by 50%, and water consumption by 30% (Dobson *et al*, 2013). Although public awareness of sustainability issues, especially environmental issues seem to be increasing, there is no definite structure for enhancing understanding, enhancing commitment, and improving sustainability performance, especially in terms of volume, especially in the Nigerian context, hence, this study.

2. Literature

2.1 Conceptual Review

2.2.1 Conventional versus Sustainable Housing Projects

A conventional housing project follows a thin sense of environmental, social, and economic profits at the expense of other(s) unlike sustainable housing projects. Sustainable housing, however, is built with clean and resource-efficient methodologies towards achieving a lesser environmental and carbon footprint compared to conventional housing (Hwang & Tan, 2012; Waniko, 2012). Also, sustainable housing projects differ in principle in terms of design, material sourcing, construction, operation, and maintenance compared to the traditional building system. For example, new technologies and techniques as well as environmentally friendly materials are used (Hand *et al.,* 2015; Li, Chen, Chew *et al*., 2011). Furthermore, sustainable housing projects often require closer coordination especially during design between the architects, engineering service team, and other stakeholders as a result of the complexity introduced and the consideration required for meeting the sustainability goal target (Palanisamy & Klotz, 2011). Generally, relative to traditional housing, sustainable building housing projects are much more resource and energy-efficient, healthier, comfortable, and attractive (Korkmaz, *et al*., 2011, Hwang & Ng, 2013).

Countless sustainable housing appraisal arrangements were recognized in various countries, regions, and territories alongside the speedy growth of sustainable construction. This is intending to establish the sustainability or non-sustainability of housing projects. Among the rating systems are the Leadership in Energy and Environmental Design (LEED) in the US; Green Building Tool in Canada; Building Research Establishment Environmental Assessment Method (BREEAM) in the UK; National Australian Built Environment Rating System/Green Star Certification (NABERS/GSC) in Australia; Comprehensive Assessment System for Built Environment Efficiency (CASBEE) in Japan; Green Mark Scheme in Singapore; Building Environmental Assessment Method (BEAM) in Hong Kong; etc. The structures of these sustainable building appraisal systems are closely large. However, the comprehensive principles applied differ to blend with the local conditions (Zuo & Zhao, 2014). Olanipekun (2017) maintained that many of the present evaluation ratings focus on the environmental features correlated to sustainable construction without rigorously bearing in mind its economic and social attributes. Consequentially, an SB Tool (a sustainable Housing Task method for assessing the sustainable performance of structures) is accepted because it integrates more societal, financial, cultural, and perceptual fundamentals (Gan et al., 2015).

Some factors promote the delivery of sustainable housing projects and Olanipekun (2017) described these factors as motivators; his study established the relationship between the motivators and performance of sustainable building projects. The identified factors will provide information on the areas to pay attention to. Gudienė *et al* (2013) also described some of these factors as success factors and used them to develop a conceptual model. Chen *et al*., (2012) focused on factors for the success of construction projects. Their study highlighted some of the stakeholder-related factors but they are limited to the design stage of sustainable projects only while this current study looked into all the stages of the project till completion. As there are factors influencing the success of all human endeavours, there are specific factors influencing stakeholders' successful delivery of sustainable housing and other building projects. Gudiene *et al*. (2013) revealed that stability of the microeconomic environment, access to credit facilities, low/favourable interest rate, implementation of sound economic policy, long-term loan payment period, favourable payment requirements, and suitable project location (Habitat and Heritage conservation) are the motivating factors that enhance the performance of sustainable housing projects. These factors positively affect in terms of early completion of sustainable construction. In addition, Chen *et al.*, (2012), Fathalizadeh et *al.*, (2022), and Davies & Osmani (2011) also identified motivating factors enhancing the delivery of sustainable housing projects to include: clear project vision, cooperation among stakeholders, community engagement, government support, experience sharing, education, and effective use of technology and computing. Ekung *et al.*, (2022), David et al., (2020), and Qian *et al*. (2015) listed other delivery motivating factors to include proper project monitoring, clear allocation of budget, end-user engagement, the constitution of a competent project team, public trust, and monitoring compliance with regulations amongst others. It was concluded that if quality attention could be paid to the performance-enhancing factors listed above, the performance of sustainable housing projects would be improved. These factors, together with their literature sources, are summarised in Table 2.1.

Table 2.1: Factors Motivating the Delivery of Sustainable Housing Projects

SN	Factors	Literature sources
1.	Stability of the macro-economic environment	Gudiene *et al* (2013); Caldera *et al* (2022)
2.	Access to credit facilities/funds	Gudiene *et al* (2013); Hwang & Lim (2013)
3.	Low/favourable interest rate	Zavadskas, Kaklauskas, & Gulninab (2005)
4.	Implementation of sound economic policy	Caldera *et al* (2022); Gudiene *et al* (2013)
5.	Long-term loan repayment period	Gudiene *et al* (2013); Maqbool *et al*., (2023);
6.	Favourable payment requirements	Gudiene *et al* (2013)
7.	Suitable project location (Habitat and heritage conservation)	Chen *et al* (2012)
8.	Appropriate design (Floor area ratio, green ratio, emission standards)	Fitriani & Ajayi (2022)
9.	Favourable political climate	Maqbool *et al*., (2023); Caldera *et al*., (2022)
10.	Government support/ guarantee	Chen *et al* (2012)
11.	Favourable legal framework	Chen *et al* (2012)
12.	Selection of appropriate materials (Reused, recycled, eco-friendly)	Gudiene *et al* (2013)
13.	Clear profit earning and distribution plan	Davies & Osmani (2011)
14.	Availability of incentives (e.g., subsidies, tax reduction)	Chen *et al* (2012); Fuerst & McAllister (2011)
15.	Clear project vision/ objective	Fathalizadeh *et al*., (2022); Iqbal *et al*. (2021)
16.	Cooperation among stakeholders	Fathalizadeh *et al*. (2022)
17.	Clear information flow/ clear line of communication	Gudiene *et al* (2013)
18.	Experience sharing and education	Davies & Osmani (2011)
19.	Community engagement	
20.	Clear project criteria and standards	Xu, Chan & Qian (2011)
21	Effective use of technology and computing	Ma *et al* (2012)
22	Collaborative design approach	Korkmaz *et al (*2010)
23	Clear government program and policy	Davies & Osmani (2011)
24	Proper project monitoring	David et al., (2020)
25	End user engagement	Qian *et al*. (2015)
26	Clear allocation of budget	
27	Constitution of the competent project team	David et al., (2020)
28	Commitment to Research	Rodriguez-Nikl *et al*. 2015
29	Stimulating the interest of all stakeholders and creating needed market	Hwang and Ng (2013)
30	Coordination and administration of trainings	Rodriguez-Nikl *et al.*, 2015
31	Clearly defined risk management mechanism	Ekung *et al.* (2022)
32	The existence of a speedy planning and approval process	Mulligan *et al*., 2014;
33	Efficient data management system	Qian *et al*. (2015)
34	Monitoring compliance with regulations	Bag & Rahman (2023)
35	Public trust	Mao *et al*., 2015

Source: Synthesis of reviewed literature

3. Methodology

The study population was determined by consulting the database of the Real Estate Development Association of Nigeria (REDAN) to identify housing developers based in Lagos State, which is the construction hub of Nigeria. These were in turn contacted to identify sites where sustainable housing projects were ongoing. A structured questionnaire was administered to 259 stakeholders involved in the execution of sustainable housing projects in Lagos State. In all, 203 responses were retrieved representing a 78% response rate. Primary data about factors motivating the delivery of sustainable housing projects were collected via questionnaire. The target respondents comprised all the stakeholders that participated essentially in sustainable housing projects in the study area. They consist of Architects, Structural Engineers, Quantity Surveyors, Project Managers, Electrical Engineers, Mechanical Engineers, Builders, and Government Regulatory Agencies. A 6-point Likert- scale of 0-5 was employed for data collection. The data collected were analysed using mean score analysis (MSA), analysis of variance (ANOVA), and factor analysis. The mean score analysis was carried out using the formula in Equation 1.

$$MS = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1 + 0n_0}{n_5 + n_4 + n_3 + n_2 + n_1 + n_0} \quad eqn. 1$$

where MS = Mean Score

Where n_o = no of respondents who answered “Not important”

n_1 = no of respondents who answered “very low”

n_2 = no of respondents who answered “low”

n_3 = no of respondents who answered “Moderate”

n_4 = no of respondents who answered “high”

n_5 = no of respondents who answered “very high”

ANOVA was used to examine the statistically significant differences in the opinions of the six stakeholders: namely, the project manager, quantity surveyor, architect, engineers, builder, and government agency.

Factor Analysis

It is a statistical tool that observes the original relationships between a huge number of variables (Leo-Olagbaye, 2021; Durdyev *et al*., 2018). Factor analysis includes two methods, first is exploratory factor analysis (EFA) and second is confirmatory factor analysis (CFA). EFA is an arranged explanation of interconnected procedures that discovers the fundamental arrangement of a group of observed variables without enforcing a predetermined arrangement on the result (Child, 1990; Fabrigar, Wegener, MacCallum & Straham, 1999). CFA validates the structure of a group of observed variables and confirms if there is any number embedded into a set of variables that affect foreseen results (Leo-Olagbaye, 2021).

4. Discussion of Findings

Evaluation of Factors motivating the delivery of Sustainable Housing Projects

To achieve the objective of this research, the level of significance of the listed factors influencing sustainable housing projects was rated by the respondents based on the categories of stakeholders on a scale of 0-5. The data obtained were subjected to Mean Response Analysis (MRA), Analysis of Variance (ANOVA), and Factor Analysis. The result obtained is presented below.

The result of MRA presented in Table 4.1 shows that all Thirty-three (33) of the identified motivating factors had a mean value of more than 3.50 which connotes that these motivating factors have a high level of significance on the delivery of sustainable housing projects. This implies that the respondents attached high significance to these motivating factors. The top 5 motivating factors of sustainable housing projects were; monitoring compliance with regulations (MS = 3.99); availability of stable macroeconomic (MS = 3.87); sustainable environment (MS = 3.87), appropriate sustainable design (MS = 3.86), efficient data management system and clear project criteria and standards (MS = 3.86).

This is followed by clear project criteria and standards, coordination and administration of pieces of training, experience sharing, and education on sustainable construction and appropriate sustainable design (floor area ratio, green ratio, emission standards). Similarly, Quantity Surveyors perceive that monitoring compliance with regulations is the most enhancing factor in the performance of sustainable housing projects. This is closely followed by proper project monitoring of sustainable construction, efficient data management system, sustainable project vision and objectives, and clear project criteria and standards. However, Architects perceived the enhancing factors differently as end-user engagement is perceived as the most important enhancing factor.

Table 4.1: Factors Motivating the Delivery of Sustainable Housing Projects

S/N	Influencing Factors	All		Project Manager		Quantity Surveyor		Architect		Engineer		Builder		Government		ANOVA	
		MS	R	MS	R	MS	R	MS	R	MS	R	MS	R	MS	R	F value	P value
1	Monitoring compliance with regulations	3.99	1	4.22	1	3.94	1	3.90	12	4.04	2	3.80	6	4.05	4	.752	.585
2	Availability of stable macroeconomic and sustainable environment	3.87	2	3.44	33	3.56	23	3.85	15	4.28	1	4.17	1	4.18	1	2.977	.013*
3	Appropriate sustainable design (Floor area ratio, green ratio, emission standards)	3.86	3	4.00	4	3.71	14	4.05	3	3.80	16	3.73	15	4.05	4	1.094	.365
4	Efficient data management system	3.86	4	3.93	10	3.82	3	4.10	2	3.80	16	3.80	6	3.85	14	.295	.915
5	Clear project criteria and standards	3.86	5	4.07	2	3.77	5	3.95	9	4.00	3	3.70	20	3.82	16	.720	.609
6	Access to credit facilities/funds for sustainable construction	3.84	6	3.70	24	3.69	16	3.50	25	4.00	3	4.03	2	4.10	2	1.579	.168
7	Sustainable project vision and objectives	3.84	7	3.93	10	3.82	3	4.00	6	3.88	9	3.70	20	3.82	16	.282	.923
8	Effective use of sustainable technology	3.84	8	3.96	8	3.76	10	3.95	9	3.92	6	3.80	6	3.82	16	.310	.907
9	The collaborative sustainable design approach	3.82	9	3.93	10	3.63	19	3.95	9	3.96	6	3.87	3	3.87	13	.779	.566
10	Constitution of a competent project team	3.82	10	4.00	4	3.77	5	4.00	6	3.72	23	3.70	20	3.85	14	.444	.817
11	Proper project monitoring of sustainable construction	3.81	11	3.85	17	3.84	2	4.05	3	3.80	16	3.67	23	3.72	28	.473	.796
12	Coordination and administration of trainings	3.80	12	4.07	2	3.73	13	3.75	20	3.72	23	3.57	28	3.97	9	1.148	.337
13	Stimulating the interest of all stakeholders and creating needed market	3.79	13	3.85	17	3.77	5	3.80	17	3.64	26	3.73	15	3.92	11	.308	.908
14	End-user engagement in sustainable designs	3.79	14	3.93	10	3.76	10	3.80	17	3.84	13	3.77	9	3.72	28	.180	.970
15	Selection of appropriate sustainable materials (reused, recycled, eco-friendly)	3.78	15	3.96	8	3.71	13	3.75	20	3.80	16	3.73	15	3.79	20	.278	.925
16	Clear allocation of the budget that ensures project success	3.78	16	3.85	17	3.77	5	3.85	15	3.88	9	3.53	29	3.82	16	.429	.828
17	Experience sharing and education on sustainable construction	3.77	17	4.00	4	3.77	5	3.65	23	3.72	23	3.77	9	3.72	28	.375	.865
18	Clear information flow toward sustainability	3.76	18	3.85	17	3.66	18	3.90	12	3.96	6	3.60	26	3.77	23	.572	.721
19	Commitment to Research	3.76	19	3.89	14	3.69	16	4.05	3	3.88	9	3.63	24	3.64	33	.750	.587
20	Cooperation among sustainable stakeholders	3.75	20	3.89	14	3.76	10	4.00	6	3.76	21	3.50	31	3.69	31	.744	.592
21	Suitable project location (Habitat and heritage conservation)	3.74	21	3.89	14	3.55	24	3.80	17	3.88	9	3.77	9	3.79	20	.660	.655
22	End-user engagement	3.72	22	3.74	23	3.58	21	4.15	1	3.64	26	3.73	15	3.77	23	1.099	.362
23	Availability of low interest rate for sustainable construction	3.71	23	3.59	26	3.44	30	3.40	27	4.00	3	3.87	3	4.10	2	2.363	.041*
24	Clearly defined risk management mechanism	3.70	24	4.00	4	3.53	25	3.90	12	3.60	30	3.60	26	3.79	20	1.119	.351

S/N	Influencing Factors	All		Project Manager		Quantity Surveyor		Architect		Engineer		Builder		Government		ANOVA	
		MS	R	MS	R	MS	R	MS	R	MS	R	MS	R	MS	R	F value	P value
25	Public trust	3.67	25	3.85	17	3.50	27	3.70	22	3.76	21	3.63	24	3.74	26	.564	.727
26	Implementation of sound economic sustainable policy	3.66	26	3.52	28	3.44	30	3.30	32	3.84	13	3.83	5	4.05	4	2.524	.031*
27	The existence of a speedy planning and approval process	3.66	27	3.81	22	3.60	20	3.45	26	3.56	32	3.77	9	3.74	26	.428	.829
28	Favourable legal arrangements for sustainable construction (codes and regulations)	3.64	28	3.52	28	3.58	21	3.55	24	3.64	26	3.47	33	4.00	8	1.252	.287
29	Long-term loan repayment period for sustainability	3.63	29	3.52	28	3.39	32	3.40	27	3.80	16	3.77	9	3.97	9	1.527	.183
30	Government support for sustainable construction	3.63	30	3.63	25	3.47	28	3.25	33	3.84	13	3.50	31	4.03	7	1.725	.130
31	Clear government programme and policy on sustainable construction	3.60	31	3.52	28	3.53	25	3.40	27	3.64	26	3.77	9	3.69	31	.365	.872
32	Availability of incentives (e.g. subsidies, tax reduction) to promote sustainable construction	3.57	32	3.56	27	3.45	29	3.40	27	3.52	33	3.73	15	3.77	23	.544	.743
33	Favourable political environment	3.55	33	3.52	28	3.39	32	3.35	31	3.60	30	3.53	29	3.92	11	1.006	.415

MS= Mean score; R = Rank; * Significant at p<0.05

This is followed by an efficient data management system, appropriate sustainable design, proper project monitoring of sustainable construction, and commitment to research.

Engineers perceived the availability of a stable macroeconomic and sustainable environment as the most enhancing factor. This is followed by monitoring compliance with regulations, clear project criteria and standards, access to credit facilities/funds for sustainable construction, and availability of low-interest rates for sustainable construction. While builders perceived the availability of a stable macroeconomic and sustainable environment as the most enhancing factor in the performance of sustainable housing projects. This is followed by access to credit facilities/funds for sustainable construction, collaborative sustainable design approach, availability of low interest for sustainable construction, and implementation of sound economic sustainable policy. The government perceived the availability of a stable macroeconomic and sustainable environment. This is followed by access to credit facilities/funds for sustainable construction, availability of low-interest rates for sustainable construction, implementation of sound economic sustainable policy, and appropriate sustainable design (Floor area ration, green ration, emission standards). The most significant enhancing factor on average was ranked 1st under Project Managers and Quantity Surveyors, 2nd by Engineers, 4th by Government, 6th by Builders, and 12th by Architects. The 2nd ranked enhancing factor on average too was not consistently ranked high by the individual categories of the stakeholders. It was ranked 1st under Engineers, Builders, and Government, Ranked 15th under Architects, 23rd by Quantity Surveyors and 33rd by Project Managers. The implication of this result is if properly understood, all enhancing factors carry different levels of significance for the different categories of stakeholders so none should be trivialized but well understood to enhance the delivery of sustainable housing projects and accelerate the building of a sustainable society.

Table 4.1 also revealed that significant differences using ANOVA existed in the views of respondents on the level of significance of 3 of the enhancing factors. This is revealed by the f-values of these enhancing factors at $p<0.05$. They include the availability of a stable macroeconomic and sustainable environment, the availability of low-interest rates for sustainable construction, and the implementation of sound economic sustainable policy. This implies that respondents perceived the level of significance of these 3 enhancing factors in the same way. It can be inferred that the category of stakeholders has a significant effect on the views of the respondents about the level of significance of these 3 stakeholder-related enhancing factors on the performance of sustainable housing projects. This signifies that they viewed the significance of these 3 stakeholder-related enhancing factors on the performance of sustainable housing projects differently; hence, the category of stakeholders had a statistically significant effect on respondents' perception of the level of significance of the above-listed enhancing factors.

However, no significant difference existed in the views of respondents on the level of significance of the remaining 30 enhancing factors. This is revealed by the f-values of these inhibiting factors at $p>0.05$; among them are: monitoring compliance with regulations, appropriate sustainable design (Floor area ratio, green ratio, emission standards), efficient data management system, and clear project criteria and standards. This implies that respondents perceived the level of significance of these enhancing factors in the same way. It can be inferred that the category of stakeholders has no significant effect on the views of the respondents about the level of significance of these 14 stakeholder-related enhancing factors on the performance of sustainable housing projects. This inferred that the category of stakeholders does not have an effect on the significance of these stakeholders-related enhancing factors on the performance of sustainable housing projects.

In order of significance, the availability of a stable macroeconomic and sustainable environment by the Government should be well improved to enhance the delivery of sustainable projects. Also, access to credit facilities/funds for sustainable construction and also availability of low interest rates by the Government for clients enhances the delivery of sustainable projects making construction materials well available for contractors and consultants. As supported by Alsanad (2015), the implementation of sound economic sustainable policies and legislation by the Government encourages clients to invest more in sustainable construction in building a sustainable society should be enforced. Proper project monitoring of sustainable construction by the Government also enhances the delivery of sustainable housing projects. Observing the study, it is noticed that the Government as a stakeholder in sustainable construction plays a big role in all of the highly rated enhancing factors and this was supported by (Martinez & Olander.,2015 and Shari 2012). Other stakeholders, as indicated by individual categories are also relevant in driving these enhancing factors. These factors all culminate in enhancing the implementation of sustainable projects.

This research substantiated the works of Martinez & Olander (2015). Shari 2012, Windapo (2014), Mushi et al., 2022, Bond 2011, Salvi & Syz 2011 among others identified several factors as drivers of sustainable construction in different aspects of construction development. The implication of this study has to do with the fact that identified enhancing factors will create avenues for achieving sustainable projects as planned, thus they should be given adequate consideration based on their level of significance established by the study.

Further analysis was carried out on the identified factors motivating the delivery of sustainable housing projects using data reduction techniques of factor analysis. To test for the suitability of the data for factor analysis, KMO, and Bartlett's tests were undertaken, and the result is presented in Table 4.2

Table 4.2: KMO and Bartlett's Test for Motivating Factors

Measures		Values
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.959
Bartlett's Test of Sphericity	Approx. Chi-Square	6129.421
	Df	528
	Sig.	.000

Table 4.2 shows the results of KMO and Bartlett's test undertaken to determine the adequacy and suitability of the data for the level of relevance of factors motivating sustainable housing projects before factor analysis via principal components analysis extraction method using varimax rotations. Based on the aforementioned, the data upon which factor analysis was carried out in this study were both adequate and suitable. Thirty-three (33) individual motivating factors were subjected to factors analysis and extraction was done after rotation which produced the result presented in Table 4.3.

Table 4.3: Total variance explained in the level of relevance of motivating factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %
1	17.51	53.06	53.06	17.51	53.06	53.06	8.797	26.66	26.66
2	3.445	10.44	63.497	3.445	10.44	63.50	7.670	23.24	49.900
3	1.371	4.153	67.651	1.371	4.153	67.65	4.338	13.15	63.044
4	1.029	3.119	70.769	1.029	3.119	70.77	2.549	7.725	70.769
5	.858	2.600	73.369						
6	.784	2.375	75.743						
7	.659	1.996	77.740						
8	.608	1.843	79.583						
9	.568	1.721	81.304						
10	.498	1.509	82.813						
11	.480	1.453	84.266						
12	.425	1.288	85.555						
13	.393	1.191	86.745						
14	.374	1.135	87.880						
15	.320	.971	88.851						
16	.313	.947	89.799						
17	.292	.886	90.685						
18	.278	.844	91.529						
19	.273	.828	92.357						
20	.249	.755	93.112						
21	.247	.748	93.860						
22	.233	.706	94.566						
23	.217	.657	95.223						
24	.213	.645	95.869						
25	.204	.617	96.486						
26	.180	.545	97.031						
27	.176	.532	97.563						
28	.163	.495	98.059						
29	.156	.472	98.531						
30	.135	.409	98.940						
31	.124	.374	99.314						
32	.116	.351	99.665						
33	.111	.335	100.00						

Extraction Method: Principal Component Analysis

Table 4.3 depicts the total variance explained by the thirty-three (33) factors and resulted in the extraction of four (4) components during the analysis. The extracted four (4) components explained a total of 70.769 variability in the original thirty-three (33) variables. Hence, this successfully reduced the complexity of the data set by using these four (4) components with only about 29.231% loss of information by the remaining twenty-nine (29) components. The rotation of sums of squared loadings reveals a percentage of variance accounted for by extracted components as listed in a uniformly distributed manner of 26.657%, 23.242%, 13.145%, and 7.725% when compared with the figures under initial eigenvalues. The scree plot produced from factor analysis is presented in Figure 1.0.

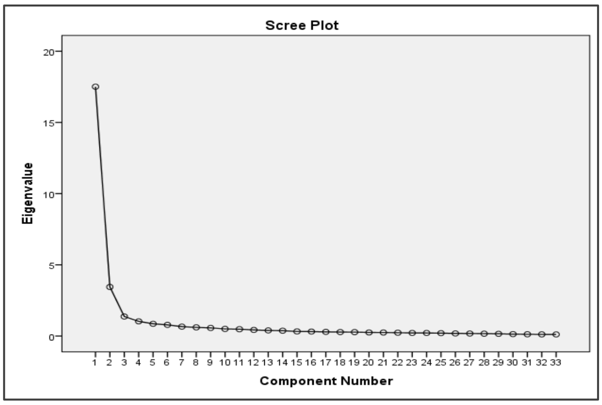

Fig. 1: Scree Plot level of significance of motivating factors in the delivery of sustainable housing projects

Presented in Table 4.4 is the rotated component matrix of the relevance of stakeholder-related factors. Table 4.4 depicts the Rotated Component Matrix for the level of relevance of motivating factors in sustainable housing projects. The table accounts for factor loadings of thirty-two (32) variables factored into four (4) components deploying the Principal Component Analysis extraction method. While adopting Varimax with Kaiser Normalization as the rotation method, the absolute value/cut-off point of 0.50 was adopted to suppress variables with small coefficients leaving fewer variables for further statistical analysis. With the absolute value of 0.60, four (4) components were eventually extracted and were named accordingly.

Component 1 – Project Related Factor (PRF)

The first component had eleven variables that are highly correlated factors which are cooperation among sustainable stakeholders (0.784), clear information flow towards sustainability (0.793), Sustainable project vision and objectives (0.789), clear project criteria and standards (0.787), Effective use of sustainable technology (0.784), collaborative sustainable design approach (0.781), end-user engagement in the sustainable designs (0.771), experience sharing and education on sustainable construction (0.692), proper project monitoring of sustainable construction (0.681), Selection of appropriate sustainable materials (reused, recycled, eco-friendly) (0.621) and commitment to research (0.576). The figures in parentheses represent the respective factor loadings. This cluster accounted for 26.657% of the variance in rotation sums of square loadings as shown in Table 4.4. The component is tagged as **Project Related Factor.**

Table 4.4: Rotated Component Matrix for the level of relevance of motivating factors

	Components			
Factors	**1**	**2**	**3**	**4**
Cooperation among sustainable stakeholders	.794			
Clear information flow toward sustainability	.793			
Sustainable project vision and objectives	.789			
Clear project criteria and standards	.787			
Effective use of sustainable technology	.784			
The collaborative sustainable design approach	.781			
End-user engagement in sustainable designs	.771			
Experience sharing and education on sustainable construction	.692			
Proper project monitoring of sustainable construction	.681			
Selection of appropriate sustainable materials (reused, recycled, eco-friendly)	.621			
Commitment to Research	.576			
Favourable political environment		.860		
Availability of low interest rate for sustainable construction		.850		
Implementation of sound economic sustainable policy		.818		
Government support for sustainable construction		.798		
Availability of stable macroeconomic and sustainable environment		.797		
Long-term loan repayment period for sustainability		.780		
Clear government programme and policy on sustainable construction		.681		
Access to credit facilities/funds for sustainable construction		.678		
Availability of incentives (e.g. subsidies, tax reduction) to promote sustainable constructior		.658		
Favourable legal arrangements for sustainable construction (codes and regulations)		.641		
Clearly defined risk management mechanism			.715	
Efficient data management system			.708	
Monitoring compliance with regulations			.683	
Public trust			.617	
Coordination and administration of trainings			.584	
The existence of a speedy planning and approval process			.568	
Stimulating the interest of all stakeholders and creating needed market			.540	
End-user engagement				.584
Suitable project location (Habitat and heritage conservation)				.576
Clear allocation of the budget that ensures project success				.569
Constitution of a competent project team				.547
% Variances	26.66%	23.24%	13.15%	7.73%
Initial Eigen Values	17.509	3.445	1.371	1.029

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

Component 2: Government Related Factor (GRF)
The second component had ten variables that are highly correlated factors which are favourable political environment (0.860), availability of low-interest rate for sustainable construction (0.850), implementation of sound economic sustainable policy (0.818), government support for sustainable construction (0.798), availability of stable macroeconomic and sustainable environment (0.797), the long-term loan repayment period for sustainability (0.780), clear government programme and policy on sustainable construction (0.681), access to credit facilities/funds for sustainable construction (0.678), availability of incentives (e.g. subsidies, tax reduction) to promote sustainable construction (0.658), favourable legal arrangements for sustainable construction (codes and regulations) (0.641). This cluster accounted for 23.242% of the variance in rotation sums of square loadings as shown in Table 4.4. The component is tagged as a **Government Related Factor.**

Component 3 – Management Related Factor (MRF)
The third component had seven variables that are highly correlated factors which are clearly defined risk management mechanism (0.715), efficient data management system (0.708), monitoring compliance with regulations (0.683), public trust (0.617), coordination and administration of pieces of training (0.584), the existence of speedy planning and approval process (0.568), Stimulating the interest of all stakeholders and creating needed market (0.540). This cluster accounted for 13.145% of the variance in rotation sums of square loadings as shown in Table 4.4. The component is tagged as a **Management Related Factor.** Most of the loading items are related to the management process

and system of the sustainable construction process and procedure. An efficient data management system and clearly defined risk management mechanism could result in the Existence of a speedy approval process. The Constitution of a competent project team could result from the coordination and administration of pieces of training, monitoring compliance with regulations, and commitment to research. Thus, this component designation is commended to display the expected character of the Management Related Factor.

Component 4 – Individual Stakeholders' Related Factor (ISRF)

The fourth component had four variables that are highly correlated factors which are end-user engagement (0.584), suitable project location (Habitat and heritage conservation) (0.576), clear allocation of budget that ensures project success (0.569), constitution of competent project team (0.547). This cluster accounted for 7.725% of the variance in rotation sums of square loadings as shown in Table 4.4. The component is tagged as an **Individual Stakeholder Related Factor.** Some of the reviewed authors include Bond and Perrett (2012); Ametepey *et al.*, (2015); Häkkinen & Belloni (2011); Martinez & Olander (2015); Shari (2012); Windapo (2014); Mushi et al., (2022); Bond (2011); Salvi & Syz (2011) identified individual factors whereas this work contributed specifically 4 groups of factors as enhancing factors or drivers of sustainable construction in the study area.

5. Conclusion and Recommendations

Regarding the motivating factors enhancing the delivery of sustainable housing, the study concluded that the 5 top motivating factors include: monitoring compliance with regulations, availability of stable macroeconomic and sustainable environment, appropriate sustainable design (Floor area ratio, green ratio, emission standards), efficient data management system and clear project criteria and standards. The study further concluded that the 33 identified enhancing factors could be parsimoniously reduced to 4 components of the project-related factors, government-related factors, management-related factors, and individual stakeholder-related factors.

All the identified motivating factors carry different levels of significance for the different categories of stakeholders so none should be trivialized but well understood to enhance the delivery of sustainable housing projects and accelerate the building of a sustainable society.

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